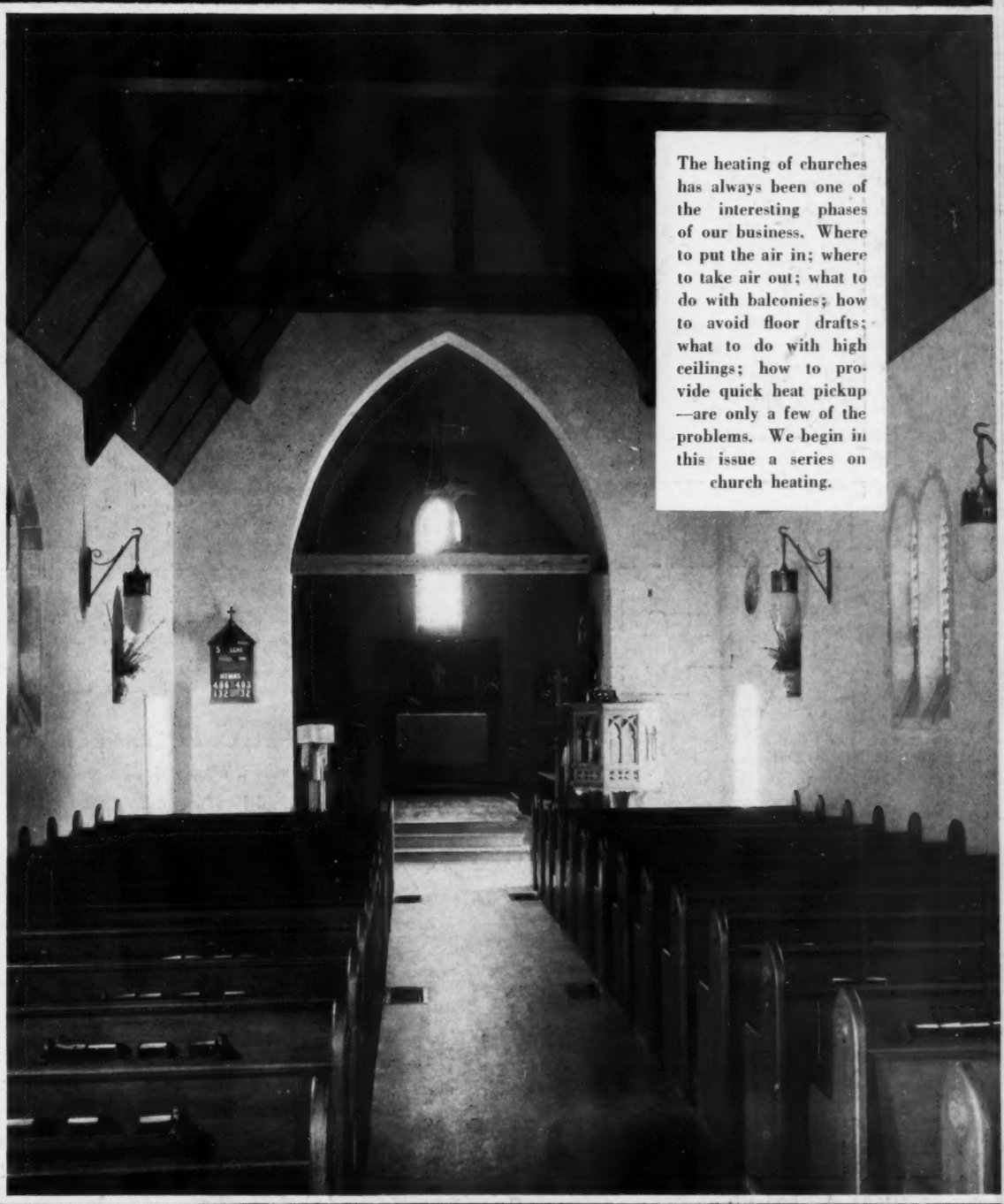
AMERICAN ARTISAN

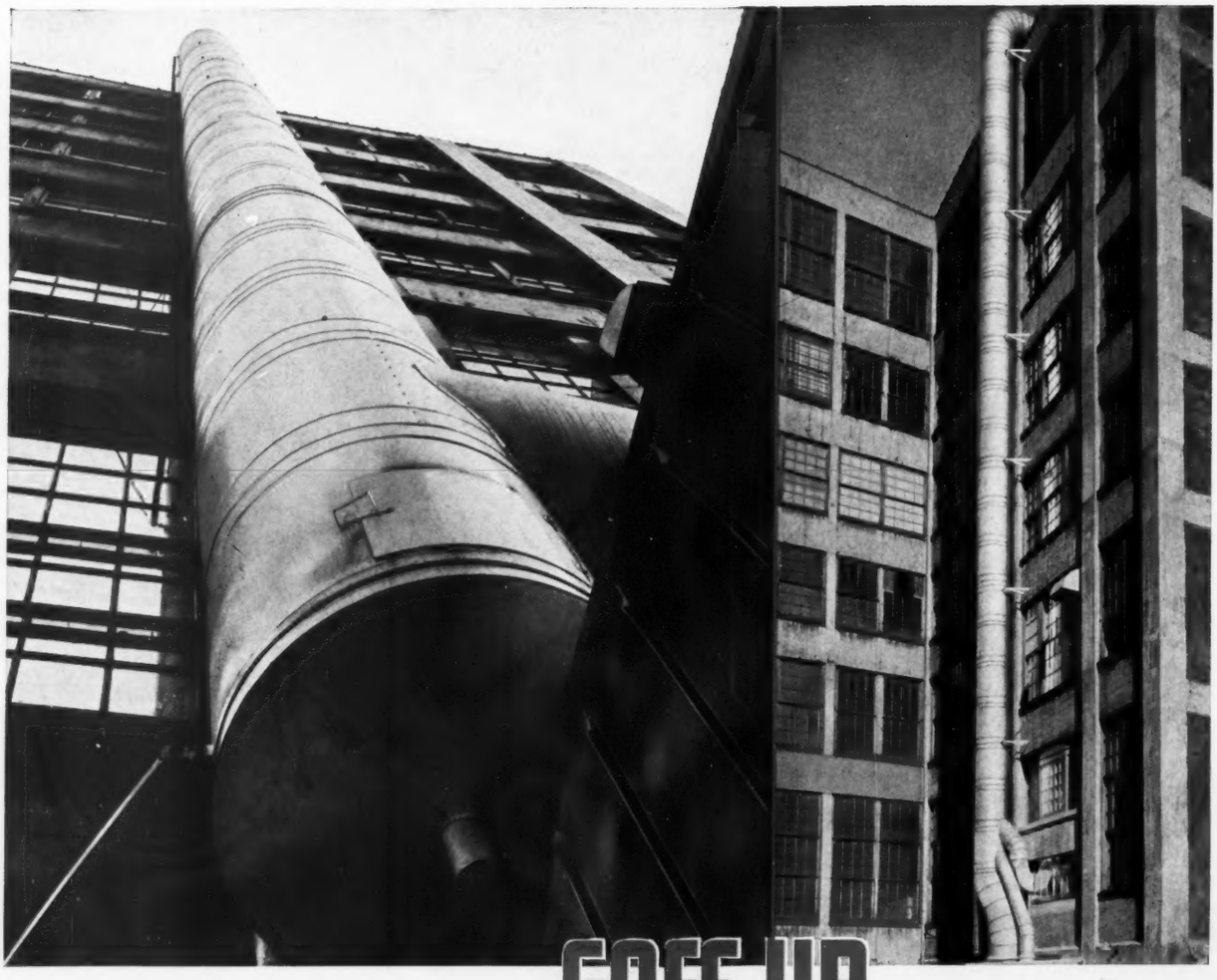
WARM AIR HEATING • AIR CONDITIONING
SHEET METAL CONTRACTING



The heating of churches has always been one of the interesting phases of our business. Where to put the air in; where to take air out; what to do with balconies; how to avoid floor drafts; what to do with high ceilings; how to provide quick heat pickup —are only a few of the problems. We begin in this issue a series on church heating.

THE AIR CONDITIONING SECTION

Page 27



TONCAN IRON GOES UP GOES UP 140 FEET

REPUBLIC STEEL
REG. U.S. PAT. OFF.
TONCAN
COPPER MO-LYB-DEN-UM IRON

Republic produces a sheet for every degree of corrosion-resistance — plain carbon steel, copper-bearing steel, copper-bearing iron, Toncan Copper Molybdenum Iron and Enduro Stainless Steel.

IN THIS DISCHARGE STACK . . . AND IT KEEPS GOING UP IN SERVICE RECORDS

Stouffer's Restaurant in Cleveland needed a new discharge stack to carry off fumes from the kitchen. They wanted a stack that would resist the attack of weather — that would last for years without need for repairs — so the sheet metal contractor used Toncan Iron. Four tons of 16-gauge sheets were required for the stack which is 140 feet high and 42 inches in diameter.

You can capitalize on the advantages of Toncan Iron — the alloy of refined open-hearth iron, copper and molybdenum with the greatest rust-resistance of any ferrous material in its price class. You can use it for every type of sheet metal application with full assurance that it will resist rust and corrosion — that your customer will thank you for a money-saving recommendation. More than 28 years of service have proved the economy and long life of Toncan Iron — and each year brings new records that keep increasing in length of satisfied service.

Send for a copy of "The Path to Permanence" and learn all about Toncan Iron, where it is being used and how easily it fabricates.

Republic Steel
CORPORATION
GENERAL OFFICES · · · CLEVELAND, OHIO

When writing Republic Steel Corporation for further information, please address Department A.A.

While others slept!
Hold-Heet Scooped the Field

Hold-Heet *Domestic* Air Conditioning Patents

1224508	1600826	1425546	1827474
1344406	1600998	1432038	1833594
1345445	1637391	1448754	1879019
1397332	1654143	1467119	1879889
1419309	1657904	1470106	1906897
1473645	1913009	1529923	1998184
1474384	1925341	1531816	2011028
1497944	1932379	1566507	2018434
1512366	1932380	1570084	2048421
1529022	1955483	1572161	355371 (C)

and other issuing.

Only Hold-Heet can have the Planoidal Blower, the Ballantine Capacitor Motor, the Hold-Heet Combustion Control, etc., etc. Only Hold-Heet can deliver dependable, complete, ample capacity equipment to give:

Complete Winter Air Conditioning and Summer Cooling

for the entire house at a price all home owners can afford. The complete equipment for average 6-room house that may be sold installed for $200

Only Hold-Heet guarantees equipment and performance with a free replacement guarantee. Not one cent has ever been paid for repairs or replacement on Hold-Heet Controls or air conditioners.

Standard Production Units--like Radios Refrigerators That you can Sell

Comes ready to Hook Up.

You do not have to be an engineer to Sell and Install Hold-Heet. With the Hold-Heet Manual and Sales Helps you have everything you need to start. The Manual that reduces Air Conditioning to its ABC's. (Read this understandable manual and you'll know more about Air Conditioning than 90% of those selling it.) Don't delay, it's the opportunity of a lifetime.

FREE

1. Sample envelope stuffers—used to find your prospects.
2. Large 6-page Consumer Circular that closes sales.
3. 20-page sales, service and installation manual.

Mail this coupon NOW!

Russell Electric Co.
342 W. Huron St., Chicago, U. S. A.

☐ Send me the Free Material.
☐ Coupon is pinned to my letterhead to show we are in the heating business and want dealer discount quotations.

NAME .....

STREET ADDRESS .....

CITY..... STATE.....

Your street address is essential on heavy fourth class mailings.

RUSSELL ELECTRIC CO., *Mfrs.*, 342 West Huron Street, CHICAGO, U. S. A.

In This Issue

A good many requests have come in asking for advice on the Robinson-Patman act. Usually we have stated that we cannot offer help because some of the country's smartest lawyers admit they are all at sea. However, J. G. Dingle on page 14, presents the important sections of the act with words of caution on how to follow the presumed intent of the law.

•

Only once in a while do we hear of an architectural metal contract in which galvanized iron is used as the material. Therefore it is with pleasure that we show one such job with details on page 12. The industry's long standing friend, George Harms, did the work.

•

In the last six years we have published an imposing list of articles by Platte Overton, but to our way of thinking, no group of articles has been as interesting as the series now appearing covering the heating and ventilating of large buildings. The article on church heating on page 22 is the beginning of a church heating discussion we consider unusually excellent.

•

G. A. Voorhees, on page 40, settles one of the toughest problems of remodeling—the problem of determining what velocity, register air temperature and air change we can use. He explains how to choose the "critical" room and work from it.

•

Part 2 of Professor Rowley's article on filters compares several general types of filters and shows just how efficiencies vary according to material, pack, air velocity through filter, length of service and so forth.

•

So much has been said on humidity that only the brave continue to publish articles, yet we still feel, that only a beginning has been made in giving the public the kind of humidification it desires. Getting back to fundamentals is always a good way to study a problem and we do this with humidification on page 45.

•

Once in a while a subject comes along which is so hot that an editor publishes it only because he likes to start an argument. For instance the matter of insulation. Is insulation advantageous? Of course, we all say yes. But what kind of insulation—and here we may get stuck. Paul Close states a case for rigid insulations on page 50 and we invite all and sundry who do not agree to tell us why they disagree.

•

The excellent article on pressure losses in elbows which ends in this issue packs more facts to a paragraph than most articles. For the reader who wants to know just what does go on before, after and in an elbow we recommend this article. Questions are invited.

AMERICAN ARTISAN

With which is merged

FURNACES and SHEET METALS AND Warm-Air Heating

Covering All Activities in

Gravity Warm Air Heating — Forced Warm Air Heating
Sheet Metal Contracting — Ventilating
Air Conditioning

J. D. Wilder, Editor

Vol. 105, No. 11 **November, 1936** Founded 1880

CONTENTS

THE AIR CONDITIONING SECTION

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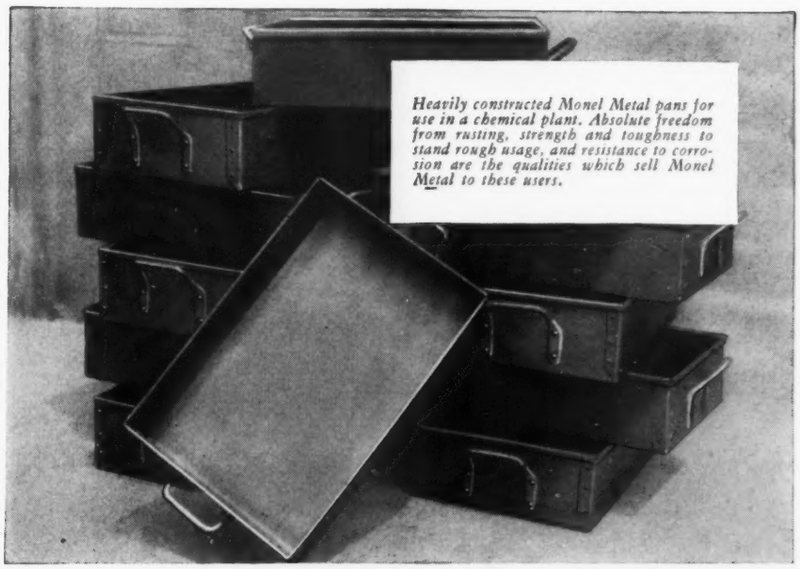
Tips on Trays



Heavily constructed Monel Metal pans for use in a chemical plant. Absolute freedom from rusting, strength and toughness to stand rough usage, and resistance to corrosion are the qualities which sell Monel Metal to these users.

No profits in being a "waiter". . . Go out and tell your customers you make trays of Monel Metal!

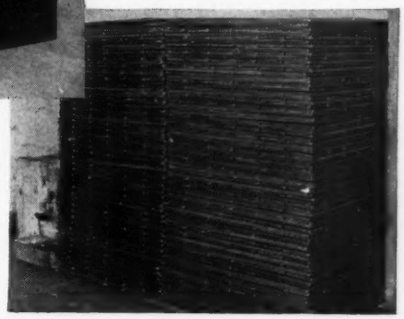
THOUSANDS of trays like the ones on this page were made and sold last year. Thousands more will be sold this year. Are you getting *your* share of the business?

It's easy business. And it's profitable business. Every merchant who handles or processes food needs trays. Bakers use them. Makers of chemicals use them. As you can see, even schools use them. These men may not know the trays they need should be Monel Metal until *you* tell them. But they'll see it soon enough when you do.

What *they* want is a tray that does not rust. That resists corrosion and cannot taint any foodstuff or other product it touches. That has the strength and toughness to stand up under rough and careless treatment. All that means they need trays of Monel Metal.

What *you* want is orders. Orders for material which can be easily worked . . . for jobs which give you an honest profit. And orders which commonly demand a large number from each customer. Monel Metal trays fit that picture too.

Fabricated Monel Metal trays used for the handling of sausage casings. These trays are readily made of Monel Metal in sizes especially suited to the packer's requirements.



(Above) Monel Metal rectangular shallow trays suitable for drying, cooling, displaying, handling and general processing of foodstuffs and related products such as edible dyestuffs and flavoring extracts. (Right) 1000 Monel Metal window flower box pans fabricated by a Minneapolis artisan for use in the public schools of Minneapolis, Minn.

Go around a few blocks in your city. Spread the word among packers, food wholesalers, laboratories and chemical plants that you can make the trays they need. It won't take you long to pick up some healthy orders. And soon after, some sizable profits from those orders.

For complete prices on Monel Metal Sheet, and full instructions for working, write *to-day* to:

THE INTERNATIONAL NICKEL COMPANY, INC.
67 WALL STREET NEW YORK, N. Y.

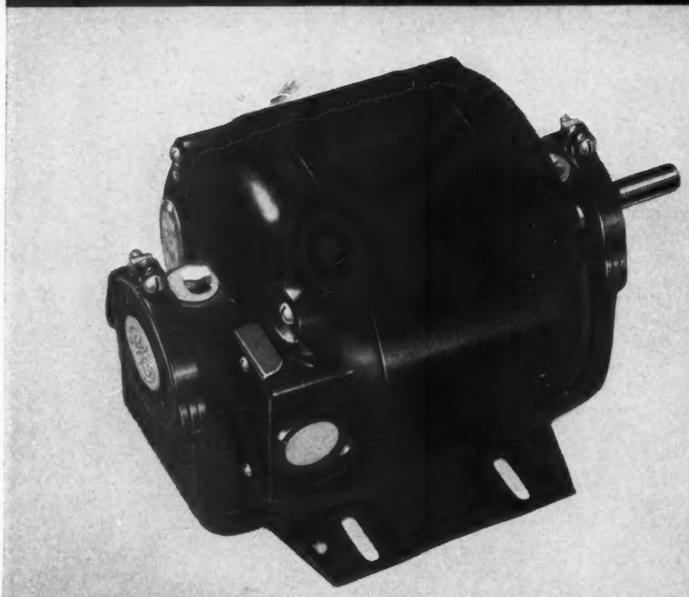
MONEL METAL

Monel Metal is a registered trade-mark applied to an alloy containing approximately two-thirds Nickel and one-third copper. Monel Metal is mined, smelted, refined, rolled and marketed solely by International Nickel.

Monel Metal

TWICE FORTUNATE
IS THIS HEATING CONTRACTOR

1. He handles a reputable make of equipment
2. This equipment is powered with G-E motors



LET G-E MOTORS HELP YOU SELL

YES, this dealer is doubly fortunate. He sells air-conditioning and warm-air equipment that is made by a manufacturer who has made good products for many years; and, in addition, this equipment is powered with G-E motors. The reputation of the manufacturer, plus the reputation of General Electric, leaves no doubt in the minds of prospects concerning the high quality of this heating equipment; thus the dealer can spend more of his time in convincing prospects of the advantages and economies of modern air-conditioning and warm-air equipment.

General Electric's high standards of quality are well known, and G-E motors have an enviable service record for quiet, dependable operation. If the heating apparatus you sell is equipped with G-E motors, you can make sales more easily because your customers will have added conviction that the products you sell will give them the trouble-free service they want.

Can you afford not to avail yourself of this added sales appeal?

General Electric, Dept. 6A-201, Schenectady, New York.

84 PER CENT SAID, "GENERAL ELECTRIC"

In a recent impartial survey, electric-appliance dealers and department stores were asked:

"What makes—or brands—of electric motors, in your opinion, would make it easier for you to sell appliances?"

General Electric was named by 84 per cent.

070-160

GENERAL ELECTRIC

AN EYE *to* PROFITS *suggests* COPPER

To THE sheet metal contractor with an eye to profits, copper is a standard recommendation. Copper means larger immediate profits to the contractor—a better job and, in the long run, better economy to the customer. Copper substantially enhances the value of your customer's property by giving it a finer appearance and greater protection over a longer period. Liberal use of copper is a recognized mark of first-class construction that will give him a lot of satisfaction in ownership—as well as solid, dependable service. Thus the advantages of copper may strongly appeal to his pride as well as to his thrift. If you push copper consistently on all your jobs, this policy will be reflected in your business with better earnings and a reputation for reliable work.

For information and specifications on any of the Revere products listed below, address our Executive Offices.

Use Cheney Flashing. This standard through-wall flashing with the famous "Z" bends gives perfect drainage, provides automatically for expansion and contraction, and assures a reliable bond in all vertical and lateral directions.

Use Revere Thru-Wall Flashing. An excellent flashing at a moderate price. Bonds in all lateral directions.

Use Revere Sheet Copper. Easily worked. Popular for roofing, flashing, gutters, downspouts, skylights, cornices, etc. Comes in hard and soft tempers, and in a variety of finishes for all requirements.

Use Revere Leadtex—lead-coated copper. For striking decorative effects, with maximum resistance to weathering and corrosion. Important features are the uniform thickness and tenacious adhesion of the lead coating.

Revere Copper *and* Brass

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FOUNDED BY PAUL REVERE 1801

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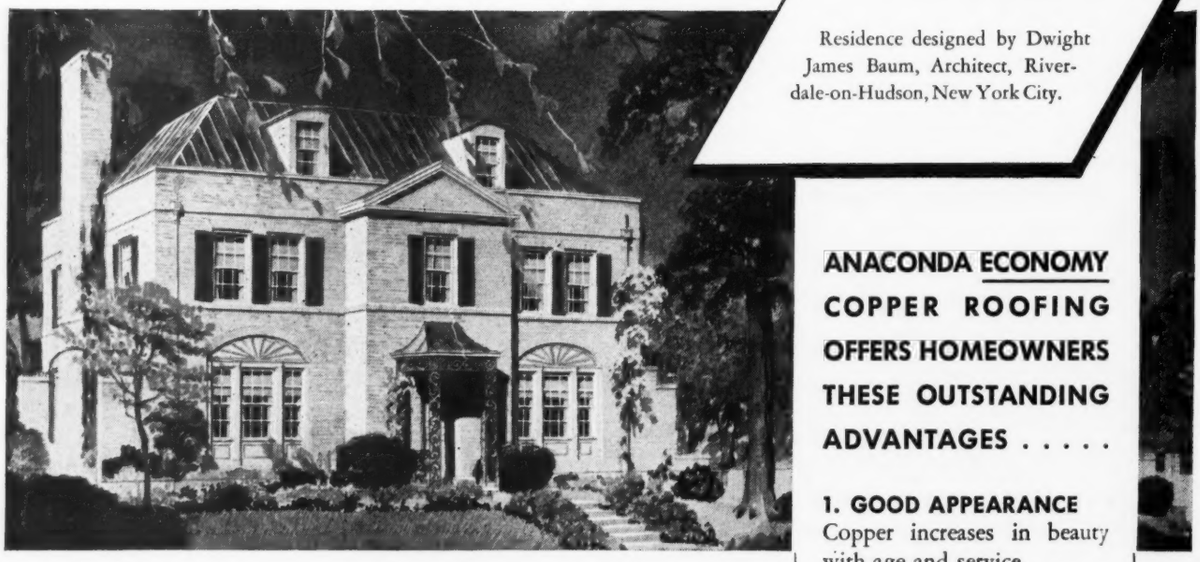
HERE'S THE WAY TO GET MORE *Residential Roofing*



Residence designed by Dwight James Baum, Architect, Riverdale-on-Hudson, New York City.

ANACONDA ECONOMY COPPER ROOFING OFFERS HOMEOWNERS THESE OUTSTANDING ADVANTAGES . . . . .

1. GOOD APPEARANCE
Copper increases in beauty with age and service.

2. DURABILITY
Permanent in spite of time and weather.

3. FIRE-PROOF
Copper roofs eliminate flying spark hazard . . . earn a low insurance rate.

4. LIGHTNING-PROOF
when properly grounded.

5. LIGHT WEIGHT
makes costly supporting structure unnecessary.

6. PROTECTS INSULATION
from damaging water or moisture.

Anaconda Economy Copper Roofing . . . durable and moderately-priced . . . meets every requirement of homeowners

Everything that homeowners want in roofing . . . durability, moderate cost, good appearance, negligible upkeep, etc. . . . is offered by Anaconda *Economy* Copper Roofing. That is why you can sell it . . . why it offers sheet metal men a new opportunity to get profitable residential roofing business. Read at the right the combination of advantages offered by *no other roofing material* . . . and use these advantages as selling points! Anaconda *Economy* Copper Roofing is carried in stock by leading sheet metal supply houses.

You have the men and the tools to install standing seam roofs. Why not get the business? Send for Publication C-7.

Anaconda Copper

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AMERICAN ARTISAN

Volume 105 Number 11

Signs of the Times

BUSINESS prognosticators again stalk the land. The signs they claim to see may be received with fear and trembling by some or with scorn by others, but the thinking man listens and weighs the claims against his experience and known conditions.

Some forecasters would have us believe that the foundation is being laid for the greatest expansion of credit this country has ever seen. And that any such credit boom will inevitably bring another depression.

Frankly we cannot judge. But we do know this—that credit expansion must have the acceptance of the buyer before it can grow. Folks must want more things than they can pay for before they use inflationary credit. And if people have not learned in the last five years that things which cannot be paid for are a mill stone around the neck of the buyer, then there is no hope and credit expansion might just as well come now as later.

Another group is trying to prove that business growth always follows and arises from new industries. Our air conditioning industry is being referred to as one such. To prove the point, these prognosticators cite the inrush of great corporations and small firms into air conditioning as evidence that our most aggressive business minds see eye to eye with them.

With this idea of future greatness we hold no argument. Air conditioning will be one of the greatest, if not the greatest, business because it satisfies a fundamental human need—comfort. But with the idea that any Tom, Dick or Harry can enter this business we take issue. Air conditioning is not a packaged business. We cannot be compared with radio or refrigeration because they are "plug-in" products, while we must satisfy a multiplicity of buyer needs, desires, preferences, purchasing ability with equipment which must be selected, assembled and installed to meet conditions which are never just alike.

Residential construction is being advertised as in the beginning of a boom. That there is, and will be a tremendous increase in the number of homes erected we do not question. Unfortunately, however, much of the publicity is emanating from interests anxious to grind some special axe and more than willing to cloud the splendid picture with their propaganda. We believe the following facts present a sensible picture.

There will be a tremendous increase in low priced houses. People are buying or building houses they can afford to maintain. Comfort is of paramount importance and for basic comfort the heating system will receive thoughtful analysis. Air conditioning is wanted, even in the lowest cost group, which means that we will have to supply the elements of winter and summer conditioning through apparatus and systems which do not seriously overstep the 10 per cent of cost basis now prevalent. Probably these small, low cost houses will mean revision of present apparatus and revamping of some accepted installation practices.

◆

Automatic Firing Devices

RECENT trips into the field and reports from contractors over the country disclose the interesting fact that automatic firing devices (stokers, oil burners, gas furnaces) have seemingly caught public acceptance squarely on the upturn of better times and better incomes and are destined to enjoy a sales volume undreamed of four years ago.

Even in territories always considered highly conservative, these automatic firing devices are hanging up new all time high records of installation. Equally interesting is the evident broadening of types of devices found acceptable, as, for example, areas which have preferred oil are now buying stokers; other localities which have preferred hand firing are now buying oil burners, stokers or gas furnaces.

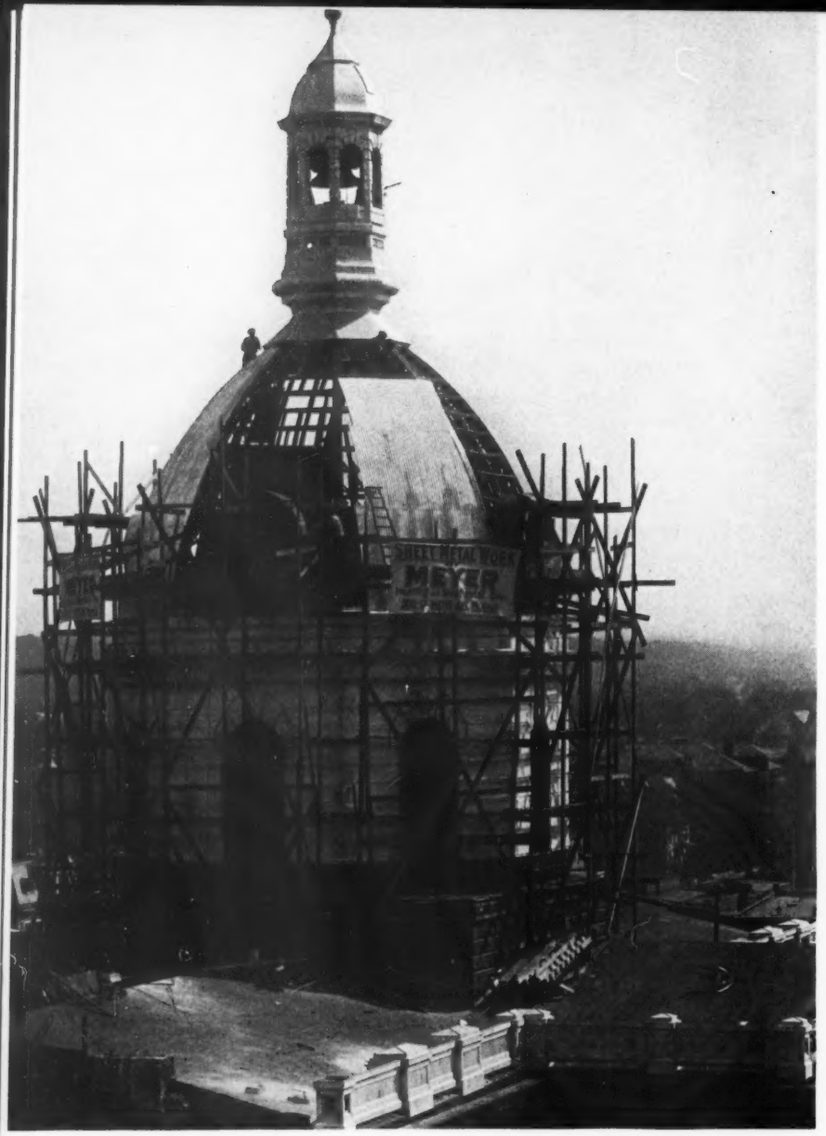
The outstanding feature of this trend, to our way of thinking, is that the heating man is in the saddle. We mean by this that the automatic firing device manufacturers in years gone by in their haste to build volume emphasized unduly the need for sales ability rather than the need for practical heating experience. The result of this preference, as everyone knows, was that too many automatic firing devices were sold as "cure-alls" for heating troubles with little thought to the condition, efficiency or adequacy of the heating plant itself.

The bitter lesson learned has shown that sales talk can never heat that cold back room, or eliminate drafts, or supply uniform comfort. It takes good design and practical experience to make a system satisfactory.

The heating man is, then, "sitting pretty." We can prove that heating experience plus reasonable sales effort result in greater buyer satisfaction than high pressure selling without any heating experience. As we view the picture there is sound reason why every heating man should sell oil burners, stokers, gas furnaces and burners. We might just as well take the profit from apparatus as give such profit to the sales agency. Even the bugaboo of service is being wiped out as devices are improved.

We further believe that heating contractor who sells ten or twenty or thirty automatic firing devices a year—but who makes every installation highly satisfactory—and who remains in business, come good times or bad, is a better guarantee of continued business for the manufacturer than the hurrah sales agency which is here today and gone tomorrow.

Reconstructing a Tower With Galvanized Iron



A RE-ROOFING project using galvanized iron was completed late in the summer in Peoria, Illinois, where the old county court house dome and roof balustrade was weather-proofed by the Meyer Heating and Sheet Metal Division of the Meyer Furnace Co., Peoria.

The court house was built in 1875 and the original dome covering was galvanized iron which after 61 years of service was still in fair condition and might have been repaired. The Building Committee of the Board of Supervisors, however, desired to make some changes in the outlines and appearance of the dome so a new construction was contracted for. Also, the four wings of the building carried as a part of the balustrade numerous stone chimneys dating back to the time of individual room fireplaces and not used for many years. The stonework of the chimneys was not in good condition so the board decided to remove the chimney tops and encase the chimneys in galvanized iron. With the intervening balustrade and piers also metal covered, a uniform and pleasing appearance, plus weather tightness would be secured.

The general construction of the metal work is shown in the facing page of details. Beginning at the pinnacle the structural framework was altered for the new tower and new sheathing was applied. A new two-ball pinnacle on an octagonal base was fabricated and installed as shown. The dome roof continues as an octagon through a base moulding which is flashed into the old stonework of the bell tower.

The new metal begins again at the floor line of the bell tower as a sill beneath the windows, provides a louvre course and a round nose moulding which projects beyond the line of the octagonal base of the bell tower. The construction photograph shows the base erected after which the ornamental brackets were applied as shown in the details.

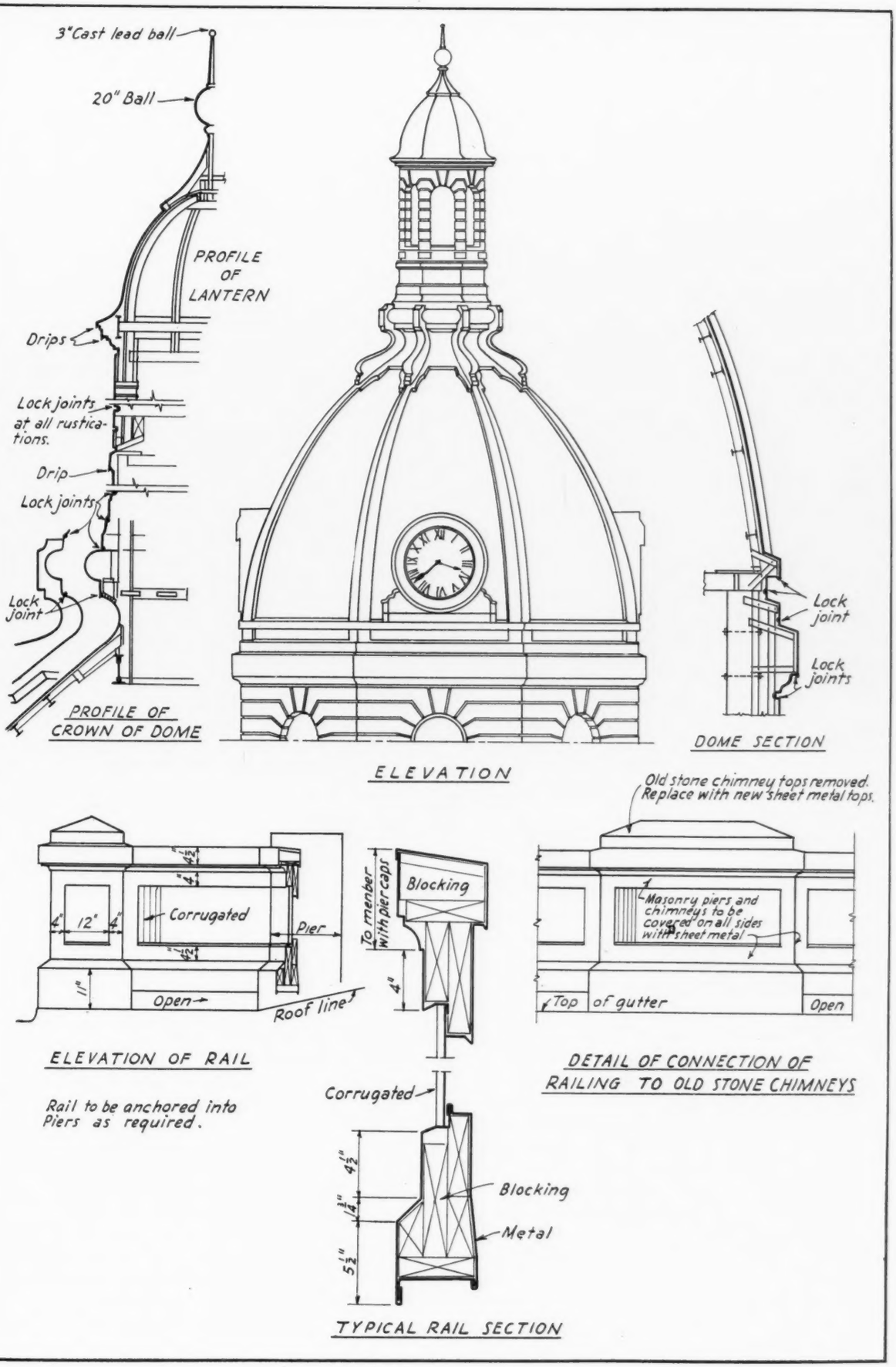
Old steel work and sheeting remained on the main dome and long corrugated galvanized iron sheets were then used as a cover. The dome is divided into four plain faces and four clock faces in which the clock projects as a dormer at the base of the dome. The circular clock faces were built up of suitable steel framing and formed wood sheathing over which the galvanized iron cover was placed.

Some interesting patterns were required to get the circular and rounded sections required for the various mouldings. Lock joints were located as drips or above projecting belt courses so that all possible chance for water accumulation in the joints was eliminated.

As stated previously the original balustrade consisted of sections of rail between the chimneys and piers. For the new rail suitable wood blocking was provided and as shown in a detail a top and bottom rail section was formed as complete units with corrugated sheet used to fill in the panel.

The chimneys were cut down and a complete top of metal was fabricated. In between the projecting top and base, recessed panels were formed with a corrugated center panel to match the panels of the rail. The general construction and dimensions are shown in the details.

The project required some 20,000 pounds of 26-gauge iron. Incidentally, the old roof of the main building was covered with tin in 1875 and is still in excellent condition.


3"Cast lead ball
20" Ball
PROFILE OF LANTERN
Drips
Lock joints at all rustications.
Drip
Lock joints
Lock joint
PROFILE OF CROWN OF DOME
ELEVATION
Lock joint
Lock joints
DOME SECTION
Old stone chimney tops removed. Replace with new sheet metal tops.
4"
12"
4"
Corrugated
Pier
11"
Open
Roof line
ELEVATION OF RAIL
Rail to be anchored into Piers as required.
To member with pier caps
Blocking
4"
Masonry piers and chimneys to be covered on all sides with sheet metal
Top of gutter
Open
DETAIL OF CONNECTION OF RAILING TO OLD STONE CHIMNEYS
Corrugated
4½"
¼"
5½"
Blocking
Metal
TYPICAL RAIL SECTION

The Robinson-Patman Act

By Joseph G. Dingle
C. P. A., Ottawa, Ill.

THE Robinson - Patman Act signed by the President on June 19, 1936, was evidently designed to strengthen and widen the prohibitions against price-discriminations first brought into Federal law by the Clayton Act in 1914. The apparent purpose of this new legislation was to prevent large buyers, particularly the chain stores, from demanding and receiving price advantages over smaller independent business organizations. Such legislation, having as it does, such far-reaching effects over business generally should have been enacted only after careful and mature study. That was not the case, and as a result, the language of this Act is such as to warrant the prediction that there is a lawsuit in every word. The Act is poorly drafted, contains many ambiguous words and phrases, and practically no definitions. It is loaded with danger for every buyer and every seller, and as to just what these dangers are we must await the interpretation placed upon the Act by the Federal Trade Commission and the Courts. As this is being written, the daily papers carry the statement that two large concerns, one a manufacturer, the other a so-called chain store, are charged with having violated the terms and conditions of this Act. These two alleged violations should be followed with interest by the American business men. They may produce an interpretation of one or more of the provisions of the Act.

We shall quote the several sections of the Act and raise questions in an attempt to bring out the points most applicable to the readers of the ARTISAN. These comments are offered as our point of view and it is suggested that readers who have some doubt as to the specific application of this Robinson-Patman Act to their business dealings should consult their attorneys.

Interstate-Intrastate

"Sec. 2 (a) That it shall be unlawful for any person engaged in commerce, in the course of such commerce, either directly or indirectly, to discriminate in price between different purchasers of commodities of like grade and quality, where either or any of the purchases involved in such discrimination are in commerce, where such commodities are sold for use, consumption, or resale within the United States or any territory thereof or the District of Columbia or any insular possession or other place under the jurisdiction of the United States. . ."

Our first comment is that the term "in commerce" should be more definitely defined. There is a Constitutional question of the power of Congress to legislate on purely INTRASTATE matters, but from the language used in (a) above, there seems to be a general coverage—any place under the jurisdiction of the United States. The interpretation of this point will materially simplify the problem. If the Federal Trade Commission is granted power over purely INTRASTATE commerce this Act will have very serious and far-reaching effect on business, both large and small.

"Discriminate In Price"

Another phrase badly in need of interpretation is "to discriminate in price". Does this mean that one must maintain the same price for every customer who buys in like grade and quantity? The words "sold for use, consumption, or resale" cover even retail sales, and this Act may be interpreted as covering the transactions of the corner grocery. But see the following apparent limitations:

"Sec. 2 (a) . . . where the effect of such discrimination may be substantially to lessen competition or tend to create a monopoly in any line of commerce, or to injure, destroy, or prevent competition with any person who either grants or knowlingly receives the benefit of such discrimination, or with customers of either of them. . ."

Here we find the limitation that such price discrimination, to come within the Act, must have the effect of substantially to lessen competition, or to create a monopoly, etc. Who can say what effect price discrimination, or price differences may have? Let's for purpose of illustration assume two furnace men bidding on a job. One previously has sold a customer a furnace for $500.00 and now quotes a prospective purchaser substantially the same furnace for $475.00. Here is a price discrimination but does it have the effect of substantially lessening, injuring, or destroying competition with "any person who either grants or knowingly receives the benefit . . ." You may say that this illustration is far-fetched and not applicable. But is it? Until the term "in commerce" is defined it may be that the illustration used above is quite appropriate and then some one must determine the effect of the price discrimination. The furnace is sold within the jurisdiction of the United States—if intrastate commerce be within the Act—there has been a price discrimination (or difference); the furnace is "for use" and there may be the "effect of eliminating or injuring competition." But wait!!!!

"Sec. 2 (a) . . . provided, That nothing herein contained shall prevent differentials which make only due allowance for differences in the cost of manufacture, sale, or delivery resulting from the differing methods or quantities in which such commodities are to such purchasers sold or delivered. . ."

Here we find that there may be differentials—those which make "only due allowance . . ." Just what is "due allowance" for differences in cost of manufacture, sale or

delivery? Who can so determine costs so minutely as to say that one job costs less to manufacture, sell and deliver than another identical job—and that the price difference was "only due allowance" for such saving. What manufacturer can say definitely the actual net saving in booking an order for 25,000 units over one for 25 units? Production costs are open to the same question —perhaps the production of the 25,-025 units was accomplished simultaneously and in that case their cost per unit would be identical. Let's assume the salesman booked both orders on the same day and in the same city. We may compute the expenses of the salesmen for the day—but can we so divide such expenses between the two orders in such a way as to compute the "due allowance"? We think not. Business is not so conducted. Averaged results are what the typical business man uses to guide his ship of industry. Perhaps the Federal Trade Commission will promulgate rules for interpreting this "due allowance" clause.

Price Differentials

"Sec. 2 (a) . . . Provided, however, That the Federal Trade Commission, may, after due investigation and hearing to all interested parties, fix and establish quantity limits, and revise the same as it finds necessary, as to particular commodities or classes of commodities, where it finds that available purchasers in greater quantities are so few as to render differentials on account thereof unjustly discriminatory or promotive of monopoly in any line of commerce; and the foregoing shall then not be construed to permit differentials based on differences in quantities greater than those so fixed and established. . . ."

Here we find the grant of power to the Federal Trade Commission to fix and establish maximum quantities for purposes of price differentials. Of course, there are no such maximums unless and until the Commission does so fix and establish them. To illustrate, suppose there are what, to the Commission, seems to be too few available purchasers for a commodity in car lots; then it is within the power of the Commission to fix and establish a quantity less than a car load as the maximum quantity on which price discriminations (or differences) may be made. One buyer may use ten car loads; another two car loads; and a third may be able to buy in single cars. But, if the maximum be established at one car load, it becomes unlawful for the seller to quote a lower price on the two-car order; or the ten-car order. Rather a large power to be placed in the hands of the Commission.

"Sec. 2 (a) . . . And provided further, That nothing herein contained shall prevent persons engaged in selling goods, wares, or merchandise in commerce from selecting their own customers in bona fide transactions and not in restraint of trade: . . ."

This is rather an unusual provision—the seller may select his customers—in bona fide transactions and not in restraint of trade. Just what does that mean? Does it mean that one may sell one customer and refuse to sell another in the same town? Is that not in restraint of trade to thus prevent one retailer from buying certain merchandise available to another retailer? This provision was in the repealed section of the Clayton Act, and, in a way, we may assume it now means just what it formerly meant. But does it? It is now in an Act much more inclusive, more confusing, and it is possible these words may have accumulated a meaning far more comprehensive. Time alone will tell.

Price Changes

"Sec. 2 (a) . . . And provided further, That nothing herein contained shall prevent price changes from time to time where in response to changing conditions affecting the market for or the marketability of the goods concerned, such as but not limited to actual or imminent deterioration of perishable goods, obsolescence of seasonal goods, distress sales under court process, or sales in good faith in discontinuance of business in the goods concerned. . ."

Here we apparently have an exemption, of price changes due to changing conditions affecting the market, etc." The phrase "such as but not limited to" would seem to broaden the conditions under which prices may be changed. But keep in mind the fact that the seller must, if charged with a violation, prove himself innocent. See the next quotation from the Act:

"Sec. 2 (b) Upon proof being made, at any hearing on a complaint under this section, that there has been a discrimination in price or services or facilities furnished, the burden of rebutting the prima-facie case thus made by showing ample justification shall be upon the person charged with a violation of this section, and unless justification shall be affirmatively shown, the Commission is authorized to issue an order terminating the discrimination."

Here is introduced a most unusual reversal of the age-worn custom of presuming one to be innocent until proven guilty. It shall be the duty of the accused, under this Act, to prove himself innocent, rather than having the accuser prove the accused guilty. But see comments under section 3.

"Sec. 2 (b) . . . Provided, however, That nothing herein contained shall prevent a seller rebutting the prima-facie case thus made by showing that his lower price or the furnishing of services or facilities to any purchaser or purchasers was made in good faith to meet an equally low price of a competitor, or the services or facilities furnished by a competitor."

This clause is rather interesting. On its face, it would seem to make the meeting of competition a complete defense. The record of the proceedings in the House shows that the sponsors of this bill intended this language not as an absolute defense but rather to permit a showing that the discriminatory price was to meet competition. They said the provision was merely "procedural"; that it does not determine substantive rights, liabilities, and duties. It leaves it a question of fact to be determined in each case WHETHER THE COMPETITION TO BE MET WAS SUCH AS TO JUSTIFY THE DISCRIMINATION GIVEN, AS ONE LYING WITHIN THE LIMITATIONS LAID DOWN BY THE BILL. If meeting competition is not a complete defense, no definite rule is laid down to guide the seller in determining when it does justify a price discrimination. It may be that a seller can meet competition when the price he is meeting is non-discriminatory and lawful. No seller can determine, in the heat of competition, whether his competitor's price is non-discriminatory and lawful unless he knows the prices given by his competitor to other buyers. Manufacturer A may have been giving all his customers in like class—

(*Continued on page* 82)

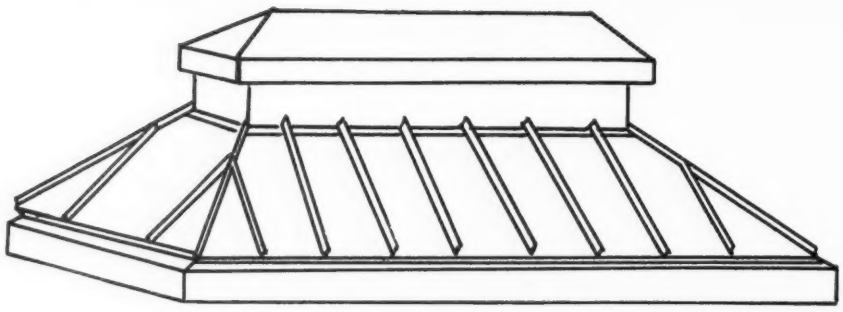


Fig. 12—Perspective of hipped skylight with ridge ventilator.

Skylight Construction

By William Neubecker

Head Instructor,

Sheet Metal Department, New York Trade School

A PERSPECTIVE view of a hipped skylight with ridge ventilator is shown in Fig. 12. The standard pitch for hipped skylights is one-third, or one-third the span as shown by B-A-C in Fig. 13. In this detail we have assumed A-C the half span or 9 inches and A-B the rise or 6 inches or $\frac{9 \times 2}{3} = 6$. Let C-B represent the glass line on which draw the profile of the common bar in its proper position as shown, and cap same as shown in previous articles. Note that the profile of the skylight curb is so drawn that the glass line C, is in line with the curb flange as indicated by the dotted line. Weep holes are placed as indicated by 4, in the center of each light.

In its proper position place the vent-curb any desired distance from the center line A-B on which draw the thickness of the glass and over this, the sections of the vent-body, brace and hood. The dotted line profile on the opposite side of the vent-curb indicates how the section of the ridge bar would appear if no ventilator were required. Note that the vent-body projects ¼ in. over the vent-curb and the hood 1½ inches.

Having drawn the sectional views in their proper relative positions, the pattern for the common bar is laid out as follows: Take the girth of the common bar, one half of which is numbered 1 to 6 and place it on the stretchout line 6-6° drawn at right angles to the pitch of the skylight as shown by similar number 6 to 1 to 6°. Through these small figures parallel to the pitch or at right angles to 6-6° draw the usual measuring lines and intersect them from similar numbered intersections 1 to

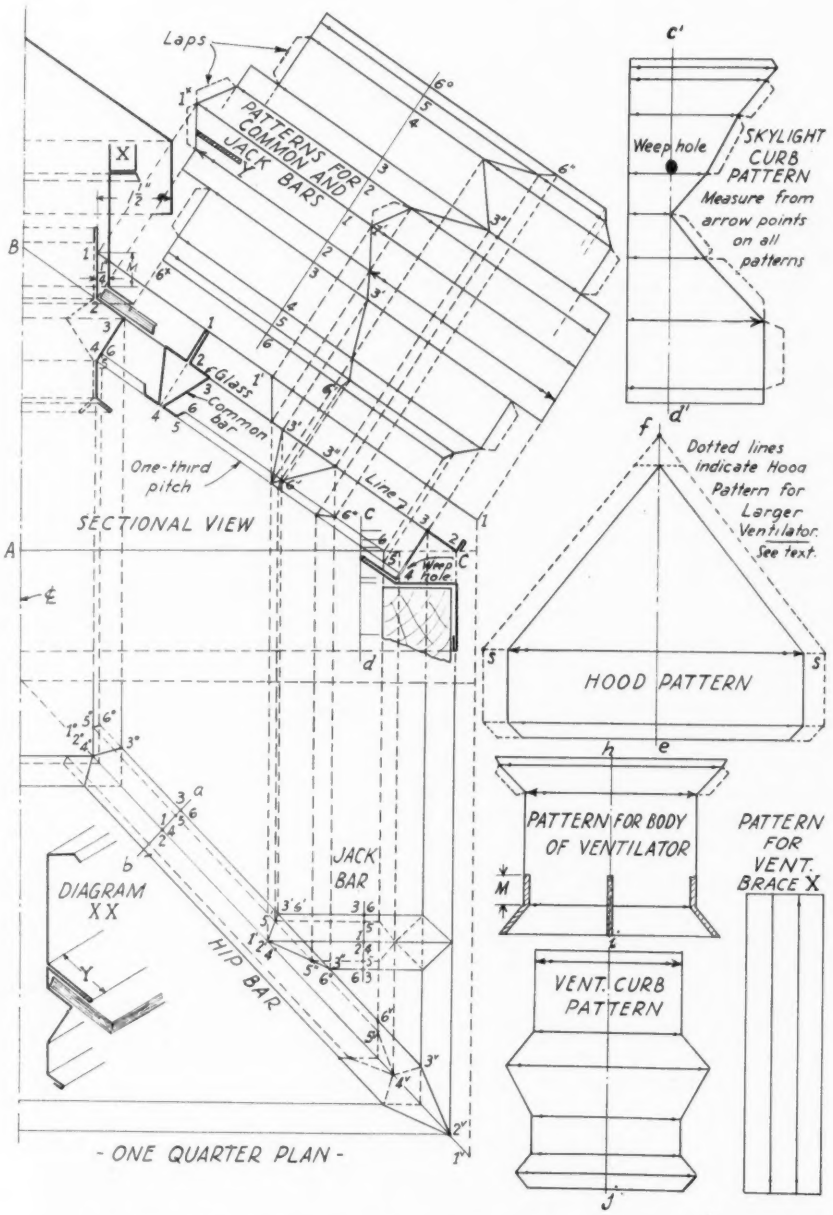


Fig. 13—Sectional view, one quarter plan, patterns for curb, ventilator, common and jack bars.

6 on the lower curb and 1 to 6 on the vent-curb at right angles to the pitch, thus obtaining the pattern intersections shown by the dotted lines.

Trace a line through points so obtained which will give the pattern for the common bar. Bear in mind that all measurements must be taken from the arrow points on *line* 2, when laying out full size lengths. Now take the girth of the lower curb and place it on any vertical line as *c'-d'* and draw the usual horizontal measuring lines. At the extreme edge of the curb profile, draw the vertical line *c-d*. Measuring from this line obtain the various projections in the profile and set them off on similar numbered lines measuring from the line *c'-d'*. Trace a line through the points so obtained, and this will be the curb pattern always measuring from arrow point

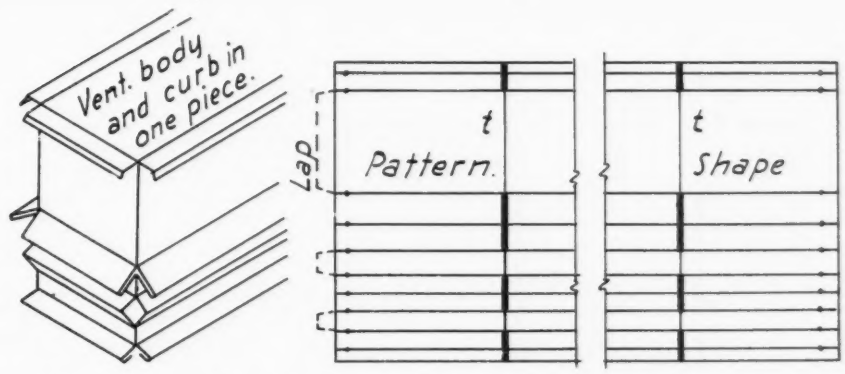


Fig. 14—Perspective view and layout for vent, body and curb in one piece.

when laying out full size lengths. Allow laps as shown.

The patterns for the vent-curb, vent-body, hood and brace are shown at the right. The three girths are laid off on the lines *f-e*, *h-i*, and *i-j* respectively and the projections obtained from the center line A-B

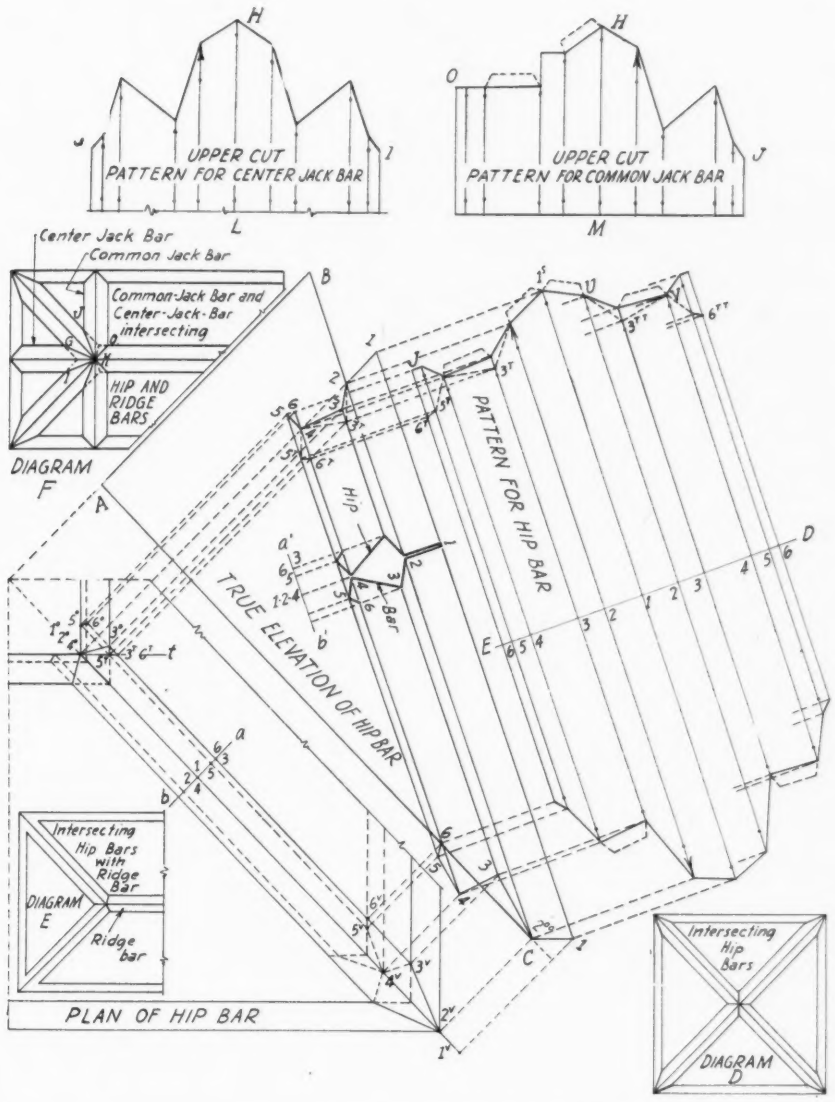


Fig. 15—Plan, true elevation and pattern for hip bar, including various miter cuts for skylight bars used in the construction of hipped skylights.

in the various profiles and place respectively right and left from the center lines shown in the patterns. The shaded notches shown in the pattern of the body of ventilator, are cut out, to allow the body to slip over the common and hip bars to the height of *m* in the sectional view. The width and length of the vent-body and vent-curb must always be measured from the arrow points.

The hood pattern shown by the solid lines is developed for a ventilator whose WIDTH is 3 inches. If this width was 4 inches or more, then simply divide this given 4 in. width by 2 and obtain 2, to which add the projection of 1½ in. shown in the sectional view and make the distance in the hood pattern on either side of the center line, 3½ inches as shown by the dotted lines at *s* and *s* and from these points draw lines parallel to the pitch of the hood until they intersect at *f*. This applies to any *width* of ventilator.

The pattern for the brace X shown in the sectional view is indicated by X at the lower right and is made as long as the hood is wide. The ventilator body and vent-curb can be made in one piece, formed as shown in diagram XX at the lower left and will require no patterns, simply making it from one rectangular piece of metal as shown in Fig. 14 where a partial perspective view is indicated.

The pattern shape at the right represent a reduced girth of the profile in diagram XX in Fig. 13 which is laid out in length equal to the full size of the ventilator as shown broken in Fig. 14. All but the vertical parts in the perspective view, are shown notched and slotted in the pattern by the heavy dashes.

(*Continued on page* 98)

A Sheet Metal Milk Cooling Tank

Milk cooling tanks which will cool with available farm water are becoming more and more necessary in many dairy areas. A practical cooler, using advanced heat transfer principles, is described in this article with complete construction details shown in the illustration opposite.

By J. W. Baybutt
Instructor, Rochester Athenaeum and Mechanics Institute

IN the past sheet metal work on farms has been confined mostly to roofs, litter carriers, grain bins and miscellaneous tanks. Recently many fruit farmers have found considerable saving in time required for spraying by having a metal water storage tank set up on a support high enough to allow for gravity water flow to the spray rig. A 3-in. pipe leading from the storage tank with bottom just above the spray rig will deliver enough water to fill the spray rig tank in less than three minutes.

A Spray Rig

Previously with the one-half or three-quarter-inch piping usually found on farms an hour's time was required to fill the rig resulting in considerable total time lost throughout the whole spraying season. In the new scheme the usual small piping fills the storage tank while the spraying crew is busy in the orchard. This scheme has saved the farmer enough time to pay for the metal tank the first year, so some business has come to sheet metal contractors without much effort.

Another metal product which is rapidly gaining favor on the dairy farm is the so-called milk cooler. We are told that milk will keep longer if cooled rapidly immediately after milking. In some localities Health Bureau restrictions are becoming so stringent that some form of quick cooling is practically essential. While mechanical refrigeration is not absolutely necessary, particularly where cold well water is available, some medium must be provided to allow for the heat transmission from the warm milk. The accompanying sketches show typical details of a practical milk cooler tank. The sizes, of course, vary, depending on the number of 40-quart containers to be handled per day. Allowance must be made in the inside dimensions of the tank for refrigeration coils or the cool water piping in case of well water. The following table shows rough dimensions of tanks to accommodate various numbers of the standard 40-quart containers as dimensioned in the sketch noted "40-quart can detail."

For a greater number of cans, the sizes of the tank can be made accordingly, even going to three rows of cans deep. Handling of the inside cans becomes troublesome with three rows, so this design should not be used unless space available demands this shape.

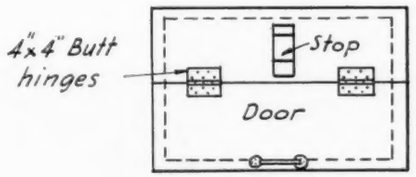
Tank Sizes

No. of Cans	Inside Length	Inside Width	Inside Height
2	36	21	28 in.
3	51	21	28 in.
4	36	36	28 in.
6	51	36	28 in.
8	66	36	28 in.

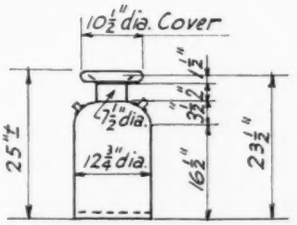
Water Levels

In some cases water leveling is controlled by patents so the designer should consult the patent office before offering such devices for sale. There are numerous schemes possible to hasten the heat transfer both from the water to the refrigerant and from the milk to the water. In every case, the rate of heat transfer is definitely dependent on the water velocities occurring, so pumping or some form of agitation is desirable to obtain best results. If cool water is available and desired by the owner, any method such as is shown in Figs. 1 and 2 will materially aid heat transfer in the original stage. Water sprayed on such a surface will find its way to cover all the surface below the point of application with a resultant high velocity and better heat transfer rate.

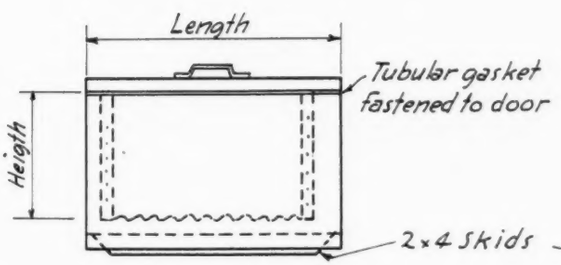
Construction details of tanks found practical are shown in the facing drawing. The contractor will make such changes as his equipment dictates, of course.



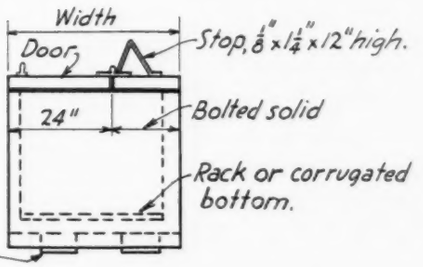
PLAN



DETAIL OF 40 QUART CAN
Dimensions are rough - cans vary.

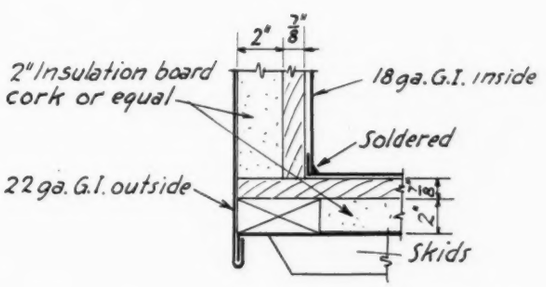


FRONT VIEW

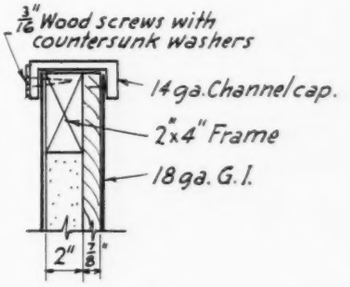


SIDE VIEW

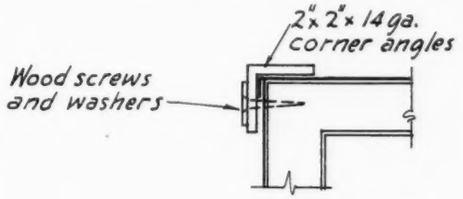
MILK COOLER TANK



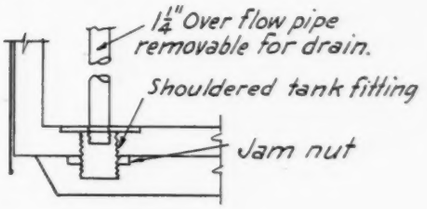
DETAIL OF BOTTOM CORNER



DETAIL OF TOP EDGE



SECTIONAL PLAN OF CORNER



DETAIL AT DRAIN

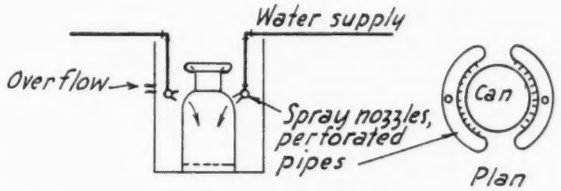


Fig. - I

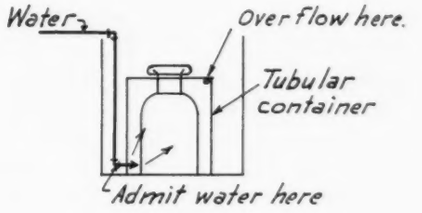


Fig. II

THE PROBLEM CORNER

Furnace Design

American Artisan:

Kindly advise me about the following matter. At present I have in hand an interesting problem to solve. To you it may be a simple problem, but as I install only gravity systems, it is new to me and I can't find a proper size of furnace for this purpose.

A customer wants me to construct a furnace which will give him 5,000 cubic meters of heated air per hour. The temperature of said air must be 65° Centigrade while entering into a drying box. The difference of intake and supply air is 50° Centigrade. Only one hot air pipe is to be connected from furnace to drying box and in that pipe is a fan capable of moving the air at rate 80 cubic meters per minute. He wants to use this installation for some drying purpose (the fruits).

I think it should be a furnace similar to those for mechanical systems, with narrow air passages around the radiator and heating surfaces.

Ordinarily to heat a house which requires 5,000 m.³ of heated air per hour, the heating plant is quite large, but this ought to be small. Where to find proper factors for this kind of figuring, I don't know.

What should be the size of the furnace grate if heating surface ratio is 20::1?

What would you recommend to take air from inside of rooms, or outside? The air is forced into drying box under certain pressure, after removing some moisture it is forced out.

He uses the wood as fuel.

V. I. K., Estonia, Europe.

Reply by
S. Konzo

Your letter of June 2 to the American Artisan has been referred to me for reply. It is a little more convenient for our purposes to work with the English units, and hence I have taken the liberty of converting your metric units to those with which we are more familiar. The conversion units to be used are as follows:

1 cu. meter = 35.314 cu. ft.

$°F = 9/5 \times °C + 32.$

With the use of these conversion factors the problem can be restated in the following terms: the air intake temperature is 59° Fahrenheit, the air outlet temperature is 149° Fahrenheit, the rise is 90° Fahrenheit, and the volume is 176,570 cu. ft. per hour. The density of the air at the drying room is 0.061 lbs. per cu. ft. The specific heat of air is 0.24 Btu per lb. The solution of the question for heat output is as follows:

H = cu. ft. per hr. × d × 0.24 × temp. rise

H = 176,570 × 0.061 × 0.24 × 90, or,

H = 233,000 Btu per hr.

where

H is the heat required at the drying room.

The determination of grate area can be made as follows:

H = c.r. × g.a. × F × E_1 × E_2

where

c.r. = combustion rate in lbs. per sq. ft. of grate area per hr.

g.a. = grate area in sq. ft.

F = fuel value in Btu per lb.

E_1 = efficiency of combustion

E_2 = efficiency of transmission

Substituting the following values in the equation, we can obtain an equation for the determination of the grate area:

F = 5590 (from Kent)

E_1 = 0.55 (assumed)

E_2 = 0.85 (assumed)

g.a. = 89.2/c.r.

If we suppose that wood can be burned at a combustion rate of 7.5 lbs., then the required grate area is 11.90 sq. ft. If for this large furnace we can assume that a combustion rate of 10 lbs. per sq. ft. can be maintained the required grate area will be 8.92 sq. ft. In metric units these areas will be 1.11 square meters and 0.83 square meters respectively.

If the air is taken from the outdoors the heat requirements will be increased, although the drying action will be better than if the air is taken from the rooms.

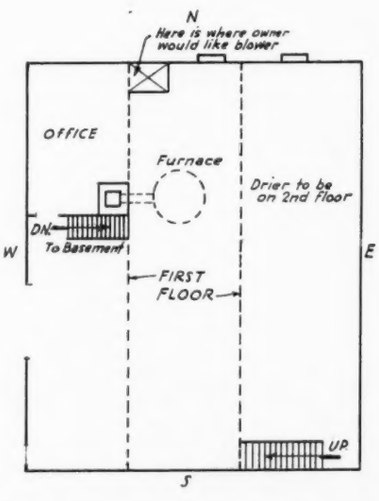
◆

Corn Drier

American Artisan:

Can you give a little advice on where would be the proper place to put a blower in a seed corn drier? The furnace is in the basement which has a dirt floor excepting where the furnace sits. Everyone so far has a different idea. The owner wants the blower on the first floor; the drier is on the second floor. Please give us some information as to what you suggest.

M. R. W., Ill.



Reply by
The Editors

We presume from your letter that the cold air to the furnace is taken off of the furnace room dirt floor; drawn through the furnace casing by the blower and introduced through registers into the second floor drying space.

We do not see any difference in operation, so far as location is concerned. The fan might be placed at the furnace to draw air through the fan, then through the furnace and through the ducts. Or, the fan might be placed on the first or second floor to pull the air through the furnace and send it along through the ducts. You should select a size according to the required warm air needed.

So far as resistance is concerned, it should be practically the same regardless of fan location, but the resistance should include air to the fan as well as air from the fan if there is any cold air piping or filters.

We are not entirely familiar with the drying process involved, and if there are other considerations which we have not accounted for, we should be glad to have your write us further.

Meeting of National Association of Sheet Metal Distributors

THE twenty-fifth annual meeting of the National Association of Sheet Metal Distributors was held October 20 in Atlantic City, in conjunction with the twenty-fifth annual meeting of the National Wholesale Hardware Association.

Undistributed Profits

In rendering the secretary's report, Secretary George A. Fernley, brought out that the overhead expense figures of members is 18.79 and the net profit 2.92 per cent. The expense percentage represents a decline of 1.17 per cent and gross margin shows a decline of 1.83 per cent. Referring to the Federal tax on undistributed profit, secretary Fernley explained that under the revenue act of 1936 it is necessary to send out dividends in order that dividend checks will reach stockholders before the 31st day of December in order to avoid taxation on that part of the profits which are not distributed. This means, according to Secretary Fernley, that many members will have to estimate how much profit is going to be made in 1936 by the 15th or 20th of December. As to ways and means of making such preliminary estimates of profit, Secretary Fernley pointed out that some organizations are considering the issuing of dividends in the form of cash and notes in order to retain some part of their cash earnings for future expansion or expense. In the discussion which followed, some members of the association advanced the thought that this may not be approved by the Internal Revenue Department, but the concensus of opinion of the meeting seems to be that such a procedure would be declared satisfactory by the Bureau. It was also emphasized that rulings of the Bureau indicate that salesmen's expense, whether paid as salary or commission, must be reported in detail, and that rough estimates of expense by monthly statement may not be approved by the Bureau. Secretary Fernley cited a letter received from the Commissioner of Internal Revenue which stated "It will be necessary for each salesman to render to his employer a complete and itemized statement of expense incurred during each calendar month." Secretary Fernley pointed out that the words complete and itemized seemed to leave no doubt as to the type of report to be demanded.

In answer to a question from the floor regarding the procedure for a firm whose fiscal does not coincide with the calendar year, Secretary Fernley stated "If your fiscal year does not coincide with the calendar year, then you are not liable for this tax for the year which ended. Let us take, for example, September 1st. If the fiscal year for your corporation ended on September 1st, you are not subject to this tax for the period from September 1, 1935, to September 1, 1936. But you are subject to the tax for the period September 1, 1936, to September 1, 1937."

Extra Items

F. J. McNeive of W. F. Potts Son & Company, chairman of the Galvanized and Black Sheets and Corrugated Roofing Committee reported that in reply to a questionnaire mailed to members, the association reported favorably on the healthfulness of the present quantity and item extras. A favorable report was received to the question "Has the establishment of present quantity and item extra brought any noticeable increase in direct mill shipment?"

Most of the members reported that there was no such increase. Most members replied "Yes" to the question "Do you favor a continuance of the present differential of $2.00 per ton now granted by the mills to distributors?" Most members reported that galvanized seconds are not being distributed to any extent in their territory. Most members reported that mills are confining the extension of present differentials to legitimate distributors in all territories. The committee reported that over 80 per cent of the membership is strongly in favor of continuance of mill differentials now granted on galvanized flat and roofing sheets.

Primes and Seconds

One interesting item in this Committee's report indicated that the sale of galvanized second sheets is largely confined to five or six of the larger cities. The Committee further recommended that some procedure be set up whereby mills would stamp prime galvanized flat sheets as "Prime Stock" or "Prime" and that such stencil marking might be made on all sheets or on the top sheet of all prime sheet bundles. Mill representatives present at the meeting expressed practically 100 per cent agreement with this procedure and agreed to stamp the top sheet of prime bundles, or all sheets if necessary, to assist in the proper identification of prime and second sheets. This recommendation of the Committee was presented as a resolution and unamiously carried.

The association was interested to discover that manufacturers of terne plate have found a considerably increased demand for their product during the last year. The Committee recommended that manufacturers enlarge their advertising of this product.

Terne Sales

A very interesting discussion centered around the question of increasing the sale of terne plates for roofing. Several of the older members explained that terne roofing had gone out of existence in many parts of the country because contractors insisted on using sheets with the coatings as light as 8, 10, 12 or 15 pounds whereas 20 pounds should be the minimum and 40 pounds the practical coating recommended.

Morris Strober cited instances where too light coated sheet and improper installation practices had ruined an otherwise good roof, and declared that these practices were responsible for the great decrease in terne plate roofing sales.

N. B. Handy declared that terne plate had lost ground to cheaper products which could be sold easier but that the terne plate roof is the best roof made today. One of the difficulties, Mr. Handy declared, is the fact that installers either neglect to paint the underside or use a very cheap paint and declared that his company used a paint costing 25 cents per square for the under coating and at least two coats of the same quality paint on the outside surface. Constant maintenance for such a painted roof, even though the plating was eight pounds, would guarantee a roof lasting for at least 40 years.

Eaves Trough

E. H. Hoffeld of The Ferdinand Dieckmann Co., chairman of the committee on eaves trough and pipe, declared that pipe and trough are rapidly becoming a mill product and consequently should be classed in the same category with sheets and that the market for pipe and trough should therefore be established by the mills when they establish their market on sheets. The Committee feels that this would develop a stable minimum market for the jobber and correct the evil of pipe and trough being offered for less per pound than the cost of the sheets from which the items are made.

Joseph Stelwagon of Stelwagon Manufacturing Company, chairman of the committee on asphalt shingles, rolled roofings, etc., explained the present merchandising plan which recognizes the service performed by a jobber by granting a functional discount of 10 per cent beyond the price

(*Continued on page* 100)

The Warm Air-Fan System of Heating and Ventilating for Churches

By Platte Overton
Chief Engineer, The Furblo Co.

In this series on heating larger buildings the author will discuss the apparatus used and engineering involved. In this article he takes a medium sized church and begins discussion of design procedure.

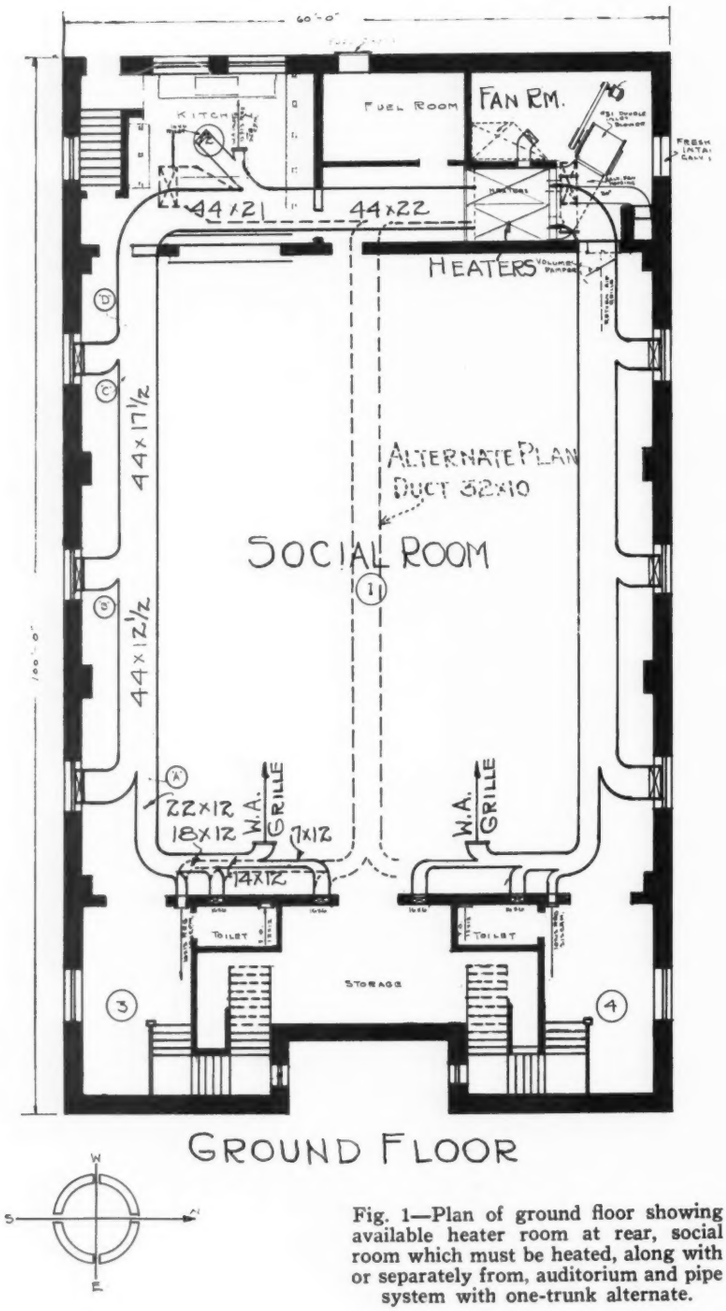


Fig. 1—Plan of ground floor showing available heater room at rear, social room which must be heated, along with or separately from, auditorium and pipe system with one-trunk alternate.

◆

ONE of the most interesting fields open to the warm air heating contractor is church heating. Heating these buildings is interesting, first because each installation is a problem of its own and because the designing of the heating system is a game in which the awards are excellent if the design is thoroughly worked out, but a tough nut when the heating plant designer misfires.

A Few Problems

Church heating offers many problems and a few are listed here:

The building may be used only a few hours per week and during the week is allowed to become thoroughly cold. The fireman may arrive an hour before church time in zero weather and must have the church warm enough for occupancy in that time. Such service is of course possible, but it calls for oversized equipment and this is not economical in first cost.

Ceilings are generally high and where such buildings have balconies, these areas will overheat before the lower floor is heated unless the system is well designed.

The architect or builders seldom have fan systems in mind when the building is designed and sufficient room for air ducts and risers is a problem.

The occupants are also a problem, as many of them insist on wearing their overshoes and overcoats while others do not dress warm enough. The doors are fre-

quently opened and the entering worshipers find it convenient to discuss the weather in the open door. These doors are large and much of the interior heat is lost to the outside.

While large audiences help warm public buildings of this type, church gatherings are hard to estimate in advance. All the seats may be occupied or again 80% of them may be empty.

The financial status of the majority of church parishes needs no mention here. The local contractor is expected to do a first class job for little or no profit and then donate a substantial sum to the general building fund.

Few churches can afford an efficient janitor; the service is generally gratis and the unfortunate individual who offers his time in this capacity does not feel that he is obliged to give any more time or thought than necessary.

The entire building is seldom used at one time, and the system must be flexible enough to heat the whole building or a few small rooms. Vestibules, toilets, and anterooms are generally in the opposite end of the building, remote from the heater room and offer the problem of freezing of water pipes, cold drafts, returns, etc.

A Typical Design

With all these problems in mind we will proceed with the design of the system for the church shown in Figs. 1 and 2. One of our first problems listed referred to high ceilings and overheated balconies. This has but one solution: a large air supply with as low a register temperature as possible.

The building is 100 feet by 60 and has a 23-foot high ceiling in the auditorium and a full basement room with a 11-foot ceiling. The walls are of stone furred and plastered inside. (Fig. 3) One-half of the basement wall is below grade and this item is important when figuring the heat loss for this room.

The data sheet is shown in Fig. 4 and is filled out and complete. However, we will check one room for the various items.

Items 1-2-3 are dimensions and are obvious if one has followed the filling out of the data sheets in the previous article. Item 4 is floor constant and factor, but this item is disregarded, as the floor is wood furred above concrete and this concrete floor is well below the grade line.

Item 5 is ceiling constant and factor and is taken in the auditorium only as this is the only room with the ceiling and roof exposed to the outside. The constant is given as .26. We must now figure the temperature difference. Our room temperature is given as 70, but here again, as in the problem of the school, we meet the problem of high ceilings and mean temperatures above that at the breathing line. Our ceiling is 23 feet above the floor line and referring to the chart in Fig. 5 we locate the 23-foot line

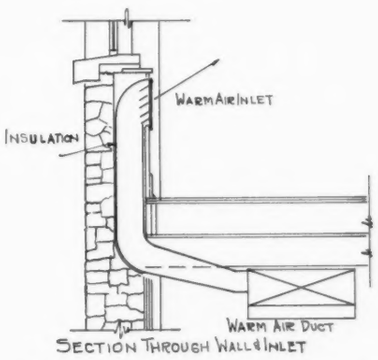
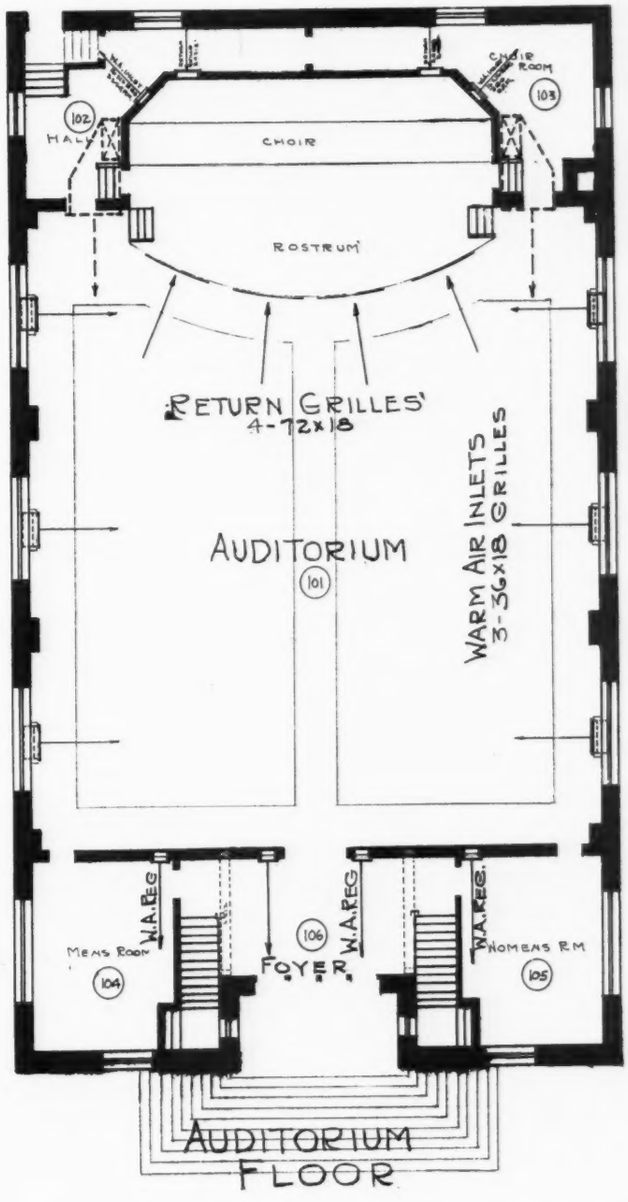


Fig. 3—Cross section of exterior wall showing construction; also a "beneath-window" register and method of hooking in duct.

Fig. 2—Plan of auditorium showing cloak rooms to be heated, balcony above foyer, rostrum, location of distribution system.



DATA SHEET

Based on -10 °F. Cold Weather & Prevailing Winds From N.W.

Exposure Factors: N 35% NE 30% E 20% SE 10% S 5% SW 20% W 30% NW 35%

Bldg. Church Date

Dist No. or Loc. Twp. Co.

Bldg. H. & V.

Archt. Engr.

Rooms No.	1	2	3	4	101	102	103	104	105	106	Totals
Use	Social	Kitchen	Hall	Hall	Audit.	Hall	Choir	Men	Women	Foyer	
MEASUREMENTS	56x60' x11'	16x18' x11'	11'x18' x11'	11'x18' x11'	56x60' x23'	9'x16' x9'	9'x16' x9'	14'x18' x9'	14'x18' x9'	27x13' x9'	
1. Room Dimensions											
2. Cubic Feet Space	36960	2765	3078	3078	106600	1296	1296	2268	2268	3159	
3. Room Floor Area	3360	288	198	198	3360	144	144	252	252	351	
4. Floor Const. & Factor					46-251						
5. Ceiling Const. & Factor											
6. Window Const. & Factor	1.2-96	1.2-96	1.2-96	1.2-96	1.2-115.8	1.2-96	1.2-96	1.2-96	1.2-96	1.2-96	
7. Wall Const. & Factor	.227-18.16	.227-18.16	.227-18.16	.227-18.16	.227-21.9	.227-18.16	.227-18.16	.227-18.16	.227-18.16	.227-18.16	
8. Exposed Sash and Door Perimeter, equiv.	132	42	16	16	288	16	32	16	16	60	
9. Leakage B. T. U. per ft. of Perimeter	100	100	100	100	100	100	100	100	100	100	
10. Expd. Wall Gross Area	1259	196	275	275	4320	361	360	270	270	171	
11. Expd. Window Gross Area	123	28	20	20	318	20	45	45	45	84	
12. Expd. Wall Net Area	1134	162	255	255	3410	241	320	230	230	87	
13. Exposure Direction	S & N	W.	S.E.	N.E.	N.E.S.W.	S.W.	N.W.	S.E.	N.E.	E.	
14. Room Temperature	70°	70°	70°	70°	70°	70°	70°	70°	70°	70°	
HEAT LOSSES											
15. Wall Loss B. t. u. per Hr.	15445	2206	3473	3473	74679	4376	5811	4116	4116	1580	
16. Window Loss B. t. u. per Hr.	11570	3456	1920	1920	165318	1970	3840	3840	3840	8064	
17. Subtotal Loss B. t. u. per Hr.	26965	5662	5393	5393	180057	6346	9651	8016	8016	9644	
18. Expos. Allow. B. t. u. per Hr.	3593	1698	539	1617	36011	1855	3480	801	2400	1933	
19. Floor Loss B. t. u. per Hr.											
20. Ceiling Loss B. t. u. per Hr.					176504						
21. Leakage Loss B. t. u. per Hr.	13200	4700	1600	1600	28800	1600	3200	1600	1600	8000	
22. Total Heat Loss	45558	11560	7532	8610	371372	9555	16331	10417	12016	19597	
23. Deduct for Heater Size	16000	2100	800	800	14400	800	1600	800	800	4000	
24. Heater Building-loss Load	38558	9460	6732	7810	356972	8755	14731	9617	11216	15597	479448
SERVICE											
25. Air Supply C. F. M.	930	240	250	285	10800	188	335	345	400	650	14423
26. Recirculation C. F. M.	862				10022	174	311				11,369
27. Air Supply Inlet Temp.	120	120	100	100	101A	120	120	100	100	100	
28. Air Supply B. t. u. Service											
29. Direct Radn. B. t. u. Service											
30. Direct Radn. sq. ft.											
31. Grav. Ind. Radn. sq. ft.											
32. Aspir. Coils Radn. sq. ft.											
33-factor page	4896	4896	30.3	30.3		4896	4896	30.3	30.3	30.3	

Fig. 4—This data sheet will be used for all the types of large structures discussed in this series. The needed information is arranged so that any one complete item can be seen for all rooms or any total of items can be found quickly.

on the left-hand side of the chart. We follow to the right until we intersect with the 70 degree line. From there we drop to the base and find that our mean temperature will be 86.5. Hence our temperature rise will be from —10 degrees below zero to 86.5, not —10° to 70. Hence our temperature rise is 96.5 times .26 equals 25.09 or 25.1 for our factor.

As the ceiling height in the balance of the rooms is 12 feet or less, this is the only room on the data sheet with this extra high mean temperature. Item 6 is window constant and factor, and is 1.2 for the constant times the temperature rise equals $1.2 \times 80 = 96$ for all rooms except the auditorium. Here we have $1.2 \times 96.5 = 115.8$ for our factor.

Item 7 is wall constant and factor, and our wall is 20-inch stone, furred, lath and plaster and is given for the constant as .227. This times the temperature rise (80) equals 18.16 for the factor for all rooms except the auditorium. Here it is $.227 \times 96.5 = 21.9$.

The four rooms on the lower floor have ½ the outside wall below grade. We assume the ground to be 30 degrees and this section of the wall has a temperature rise of 30 to

(*Continued on page* 94)

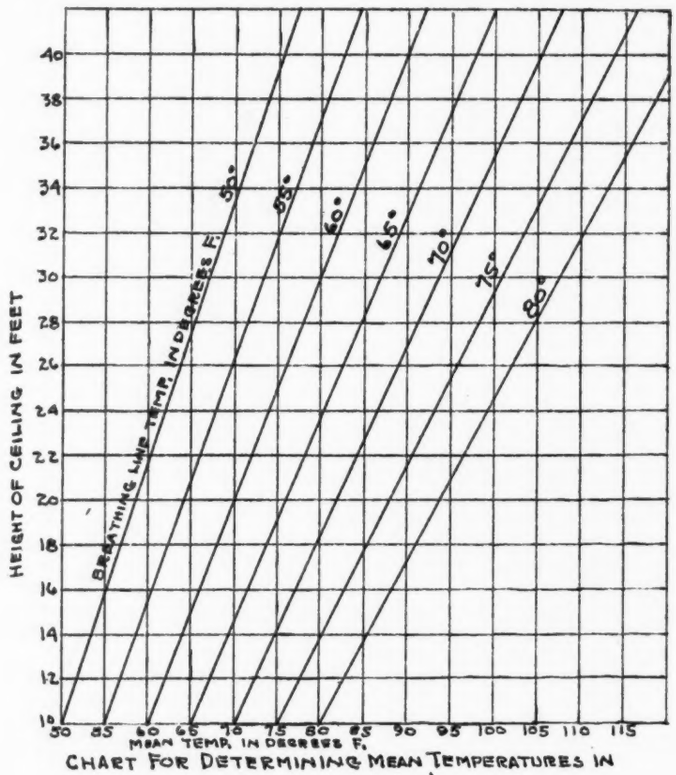


CHART FOR DETERMINING MEAN TEMPERATURES IN ROOMS WITH CEILINGS OVER 12' IN HEIGHT

CHART BASED ON FORMULA

$T_M = [(H-10)\,0.017+1]\,t_R$

T_M = MEAN TEMP.
t_R = ROOM OR BREATHING LINE TEMP.
H = HEIGHT OF ROOM

Fig. 5—Chart for finding mean temperature for high ceilings.

ASSOCIATION ACTIVITIES

Indiana Furmets

The Vincennes meeting on Friday October 23rd was made into a real outing. The coloring of the landscape enroute was at its best and all enjoyed looking over the George Rogers Clark Memorial.

Bill Teschner made elaborate plans to treat the Furmets to Wabash catfish and other fine things.

Mr. Simons showed his picture on Heat Controls—a subject so intricate that all could well afford to pick up a few good pointers.

George C. Joslin,
Secretary.

◆

NWAH and ACA Convention

The Warm Air Heating and Air Conditioning industry may look forward to the December convention of the National Warm Air Heating and Air Conditioning Association for real inspiration and an opportunity to be reliably posted on timely subjects.

The program has not been completed, but it is settled that among the pertinent subjects to be presented will be interesting and helpful information relative to merchandising under present conditions, and why merchandising and engineering must now be combined. Then, there will be something practical about summer cooling as well as, how to best take advantage of the industry's present great opportunity, while valuable reports from the association's research work which is carried on in cooperation with the University of Illinois will furnish much new information. The latest as to the Robinson-Patman Act is also promised.

In place of an evening banquet there will be a special noon day luncheon on Wednesday with a surprise entertainment.

The dates of this meeting are December 15-16-17. The place, Stevens Hotel, Chicago, Illinois.

There will be a meeting of the Board of Directors and Committees on December 15, with convention sessions on the 16th and 17th.

The reduction in passenger rates last June eliminated the special fare and one-third round trip. The new rates are equal or slightly less than the former fare and one-third.

As authorized by the Board of Directors the outside of the Association's Research Residence has been repainted and presents a most attractive appearance. This not only improves the looks of the house but will properly preserve it. Inside and out the research residence is now in splendid shape.

The Installation Codes Committee under the direction of its Chairman, Prof. J. D. Hoffman is continuing its work on the code for the Design and Installation of Mechanical Warm Air Furnace Heating Systems written in Btu. Terminology. In session in Chicago, September 18th and 19th, this committee hopes to complete the code by the time of the December convention.

Through the courtesy of the University of Illinois the Association's general office has distributed to members copies in pamphlet form, of the "Papers Presented at the First Annual Conference on Air Conditioning" held at the University of Illinois last May. The papers included are as follows:

What Is Air Conditioning?—Comfort Conditions and Physiological Factors in Air Conditioning—Air Conditioning and Its Effect on Hay Fever and Pollen Asthma—Physical Factors Affecting Comfort—Air Filters in Air Conditioning Systems—Air Conditioning Equipment—Essential Features of Heating Systems — Estimating the Humidification Requirements of Residences—Factors Affecting Fuel Saving—Calculation of the Refrigerating Load—Research in Summer Cooling at the University of Illinois.

Allen W. Williams,
Managing Director.

◆

Secretaries Conference

The October 12 meeting of the Secretaries Conferences of Mid Western state associations was held at Fort Wayne, Indiana, at the Wayne Hotel, 119 West Columbus Street, at 10 a. m., for the continuation of the discussion regarding sheet copper and Michigan plan.

Paul L. Biersach,
Secretary.

◆

Wisconsin

The October meeting of the Board of Directors of the Sheet Metal Contractors' Association of Wisconsin, was called to order by Director W. Gehrke. It was decided to publish the yearly "Year Book and Buyers Guide" and the secretary was given full charge. It was also decided to offer cash prizes to the first registering ten members, they to be entitled to draw the prize at the end of the first session. Cash attendance prizes are also to be offered as arranged by the Convention Committee. Reservations and registrations for the Annual Convention are set up at $1.50 for those attending. Ladies will be free.

Paul L. Biersach,
Secretary.

◆

Wisconsin

The Sheet Metal Contractors Association of Wisconsin has decided to hold their next convention on Monday and Tuesday, February 1st and 2nd, 1937, at the Republican Hotel, Milwaukee, Wisconsin.

The Convention Committee appointed to take charge of the convention consists of the following members:

Chas. W. Pansch, Racine; Alfred C. Goethel, Milwaukee; Paul Biersach, Milwaukee; Palmer Hanson, La Crosse; Wm. Gehrke, Sheboygan; John Goodwin, Milwaukee; Frank Kramer, Milwaukee; J. B. Wallig, Kenosha; C. F. Warning, Oshkosh; R. S. Suettinger, Two Rivers; C. F. Goldstone, Menominee, Mich.; R. F. Gehrke, Shawano.

The Convention Committee is now at work planning for this event and promises an educational program including the necessary entertainment.

Paul L. Biersach,
Secretary.

Association Activities . . . . .

Milwaukee

The October meeting of the Master Sheet Metal, Heating, Ventilating and Air Conditioning Contractors Association of Milwaukee was held at the Builders Exchange, 774 North Broadway, Milwaukee, Wisconsin, and called to order by President R. H. Fetting.

Chairman Goodman of the Membership Committee reported that his committee was active on the associate membership drive, and that provisions were also being made for activity on active members.

Chairman Walter Arndt of the Entertainment Committee agreed with members that some arrangements should be made for some class of entertainment in the near future.

Paul L. Biersach submitted the minutes as to the activities of the Code and/or License body at their first meeting with comments as to the future activities of the committee, such as inviting authorities on Codes and License laws, so as to obtain such data and information which might be applicable to Milwaukee conditions.

The secretary reported that at a meeting of the Building Congress invitations were presented for the 1937 Home Show house on which all the crafts were asked to participate. Owing to the shortness of time it was deemed inadvisable to participate.

Alex G. Riebs, manager of the Union Credit Company, who had been invited to appear before the members, explained and analyzed their service in the minutest form, explaining that it was necessary for every contractor to have a clear working title on every project under his supervision, even before work is commenced. He submitted and explained their various forms under which their service is based.

Member Graunke's Quality Adjustable Hand Saw for Extension Use was then raffled with the result that member N. F. Arndt, whose number was four in the book of registry, was the lucky winner.

Paul L. Biersach,
Secretary.

◆

Columbus, Ohio

The first meeting of the year of the Sheet Metal Contractors Association of Columbus, Ohio, affiliated with the Ohio State Association of Sheet Metal Contractors, was held on Wednesday, October 21, and was called to discuss recent changes in rates affecting the industry, by the State Industrial Commission.

A committee consisting of H. B. Snyder as chairman, Stanley Allen, Herbert Dailey, and A. E. Bogen, was appointed to meet with the State Commission and discuss the possibility of a change in a ruling by them which makes all shop work incidental to roofing or sky-light work, take the same $8 rate as obtains while the men are working directly on the job. The rate for shop work is $1.10.

The Commission explains their ruling as due to the fact that in their belief much actual construction work has been reported as shop work. The roofing fund is showing a deficit and a raise in roofing rate is necessary unless this ruling stands.

Convention Dates

National Warm Air Heating and Air Conditioning Assn.—December 15, 16, 17, 1936—Stevens Hotel, Chicago.

Sheet Metal Contractors Assn. of Wisconsin—February 1, 2, 1937—Republican Hotel, Milwaukee.

Sheet Metal Contractors Assn. of Ohio—March 16, 17, 18, 1937—Carter Hotel, Cleveland.

Sheet Metal and Warm Air Heating Contractors Assn. of Indiana—January 19, 20, 21, 1937—Lincoln Hotel, Indianapolis.

American Society of Heating and Ventilating Engineers—January 25, 26, 27, 1937—Hotel Statler, St. Louis, Mo.

National Assn. of Sheet Metal Distributors—May, 1937, Cleveland.

National Oil Burner and Air Conditioning Exposition—March 15-19, 1937, Philadelphia.

The committee has found that compensation insurance has been paid into the fund on the roofing manual by only 530 roofers. This seems entirely out of line and it will be the recommendation of the committee that measures be taken to force the operation of this act on all roofers in the state employing three mechanics or more, which is in accordance with the law now pertaining.

H. B. Snyder,
President.

◆

Ohio

The convention committee of the Ohio state sheet metal convention to be held at the Carter Hotel in Cleveland on March 16, 17 and 18, 1937, is as follows:

W. E. Feiten, Chairman.

D. A. Mannen, Program Committee.

Joe Hagen, of J. M. & L. A. Osborn Co., Finance Committee.

Milton Thesmacher, Entertainment Committee.

C. L. Mosely of Chase Brass & Copper, Salesmen's Auxiliary.

Mrs. D. A. Mannen, Ladies' Auxiliary Committee.

The Sheet Metal Employers Association, Inc., is planning to make this the greatest State Sheet Metal Convention in history.

M. J. Cutter,
Secretary.

◆

New Jersey

A suggestion made at a recent meeting of the Air Conditioners Association of New Jersey was the licensing of air conditioning engineers and contractors.

The suggestion was made by the speaker of the evening, J. C. Welch, resident engineer of The Fox Furnace Co. His subject was "What Constitutes Good Practice in the Installation of Residential Air Conditioning Systems?"

The speaker mentioned a number of serious installation mistakes, which usually prove costly to the heating contractor and reflect discredit on the air conditioning industry.

Officials of many communities are enacting codes to protect owners of air conditioned homes. These codes, Mr. Welch said, should be prepared and promoted by experienced air conditioning contractors. "To be effective," he said, "the code should have teeth, and all air conditioning engineers and contractors should be licensed!"

During the discussion that followed, it was agreed that whereas steam engineers, electricians, plumbers and others who have responsibilities in safe-guarding health and property are licensed, so should air conditioning engineers and contractors be licensed.

The regular monthly meeting will be held at 8 p. m., Monday, November 10th, in the air conditioned basement of the Public Service Building, 252 Main Street, Orange, N. J.

W. L. Todd, resident engineer of the Trane Company, will address the association on the subject of "Split Steam Air Conditioning Systems."

All members of the association and others in the air conditioning industry who merit a reputation for quality of service who may desire to join the association are cordially invited to attend. Come early and get acquainted with leaders in the industry.

Robert A. Mager, Secretary,
Anthony Menke, President.

EVO

RESIDENTIAL AIR CONDITIONING SECTION

WE begin publication in this issue of a very fundamental series of short articles on humidity. The material originally appeared in pamphlet form published by the Dominion Fuel Board of Canada. The material is, we believe, suitable for explanation of humidity to the prospective buyer.

- - - G. A. Voorhees continues his series on remodeling with some words of advice on the tie-up between selling and engineering. He also discusses a subject which frequently worries contractors—the relationship of air change to temperature and cfm—and explains how to choose the critical room and work from it.

- - - And for those who are thinking about insulation, the article on rigid insulation and the effect of increasing thicknesses will be found thought provoking. Later articles will present the case for fill insulations.

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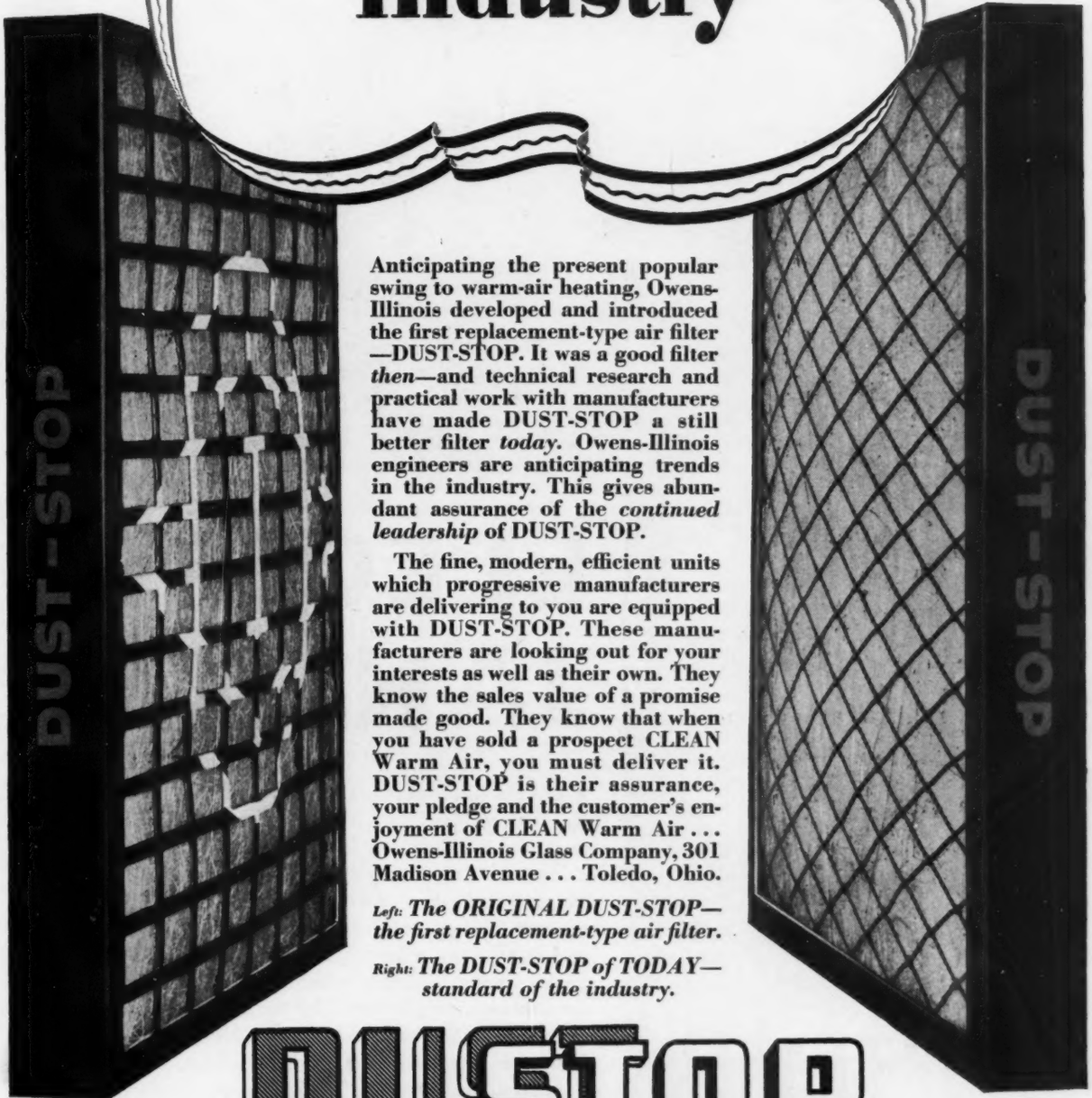
progressing with the industry



Anticipating the present popular swing to warm-air heating, Owens-Illinois developed and introduced the first replacement-type air filter —DUST-STOP. It was a good filter *then*—and technical research and practical work with manufacturers have made DUST-STOP a still better filter *today*. Owens-Illinois engineers are anticipating trends in the industry. This gives abundant assurance of the *continued leadership* of DUST-STOP.

The fine, modern, efficient units which progressive manufacturers are delivering to you are equipped with DUST-STOP. These manufacturers are looking out for your interests as well as their own. They know the sales value of a promise made good. They know that when you have sold a prospect CLEAN Warm Air, you must deliver it. DUST-STOP is their assurance, your pledge and the customer's enjoyment of CLEAN Warm Air . . . Owens-Illinois Glass Company, 301 Madison Avenue . . . Toledo, Ohio.

Left: The ORIGINAL DUST-STOP—the first replacement-type air filter.

Right: The DUST-STOP of TODAY—standard of the industry.

DUSTOP

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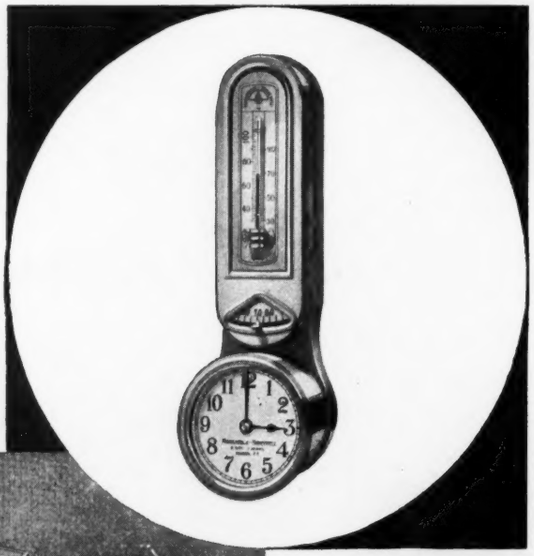
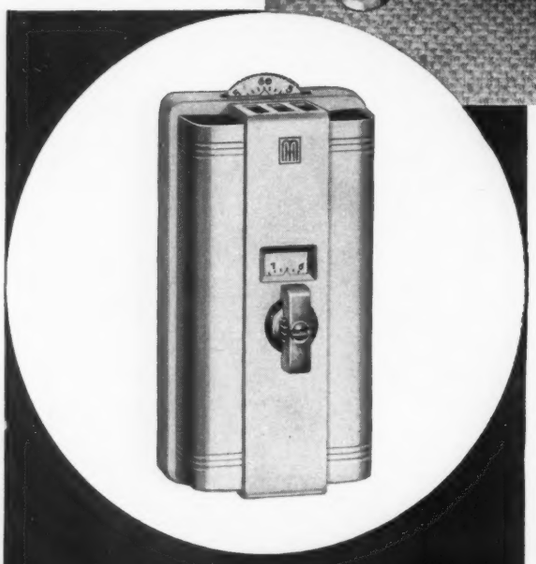
Lowered Night Temperature with the..



The Time-O-Stat, when used with heat leveling thermostat converts the standard package into the Time-O-Stat DeLuxe Electric Janitor Package. . . . A simple twist of the fingers sets the Time-O-Stat so that it automatically restores the day time level at the selected hour. It provides the advantages of lowered night temperature at minimum cost.

8 Day Clock Thermostat with heat leveling feature. Used in place of standard thermostat, it converts standard package into DeLuxe Electric Janitor package. Automatically lowers temperature at night and restores it in the morning at selected hours.

Standard Electric Janitor package, including heat leveling thermostat, electric motor, transformer and all necessary fittings....



ELECTRIC JANITOR

LOWERING temperature at night or during periods when the day time heat is not necessary, results in fuel savings amounting to 3.2 per cent for every degree the temperature is lowered. This saving can amount to 10 to 30 percent during the course of a heating season. In addition to the standard Electric Janitor package, which maintains leveled heat at all times without manual attention, there are two Electric Janitor packages which provide the economy of lowered night temperature. Like the standard package, the deluxe packages are very moderately priced, yet are Minneapolis-Honeywell quality throughout. Minneapolis-Honeywell Regulator Co., 2726 4th Ave. So., Minneapolis, Minn. Branch and distributing offices in all principal cities.

■

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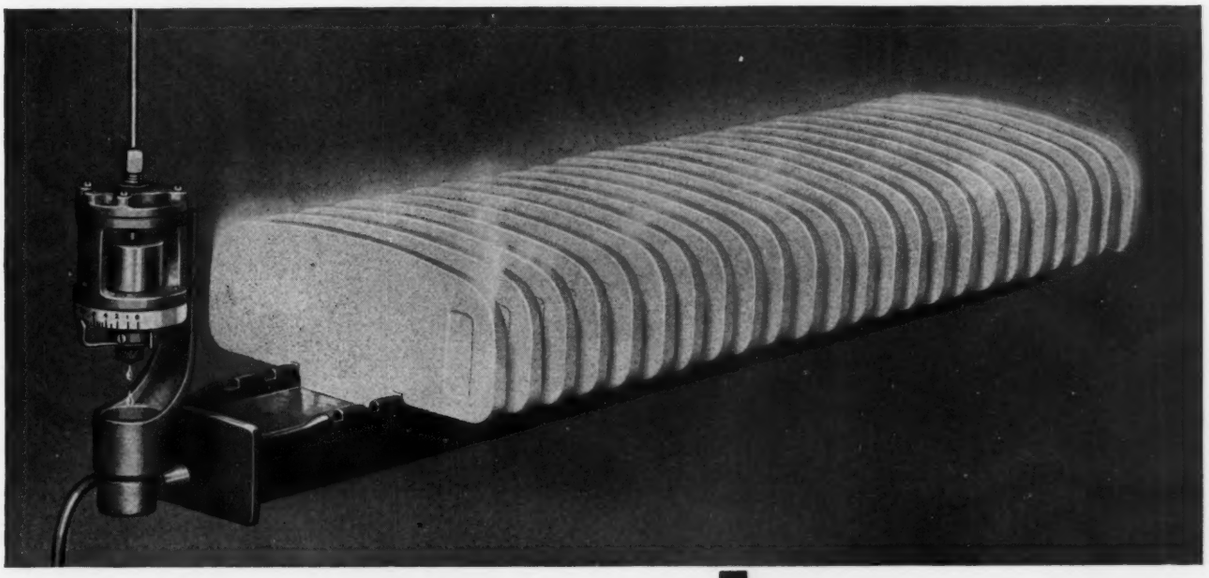
AUTOMATIC JUNE

Room or Basement Controlled HUMIDIFYING SYSTEMS



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With an Automatic June Hydro-Metric Humidifying System room humidity is graduated to attain the maximum humidity that health demands and weather conditions permit. This prevents damaging condensation on walls and windows by progressively reducing indoor humidity as weather becomes colder, without the use of costly delicate instruments. . . . Its very small area does not interfere with the free circulation of air in the heating chamber; yet its evaporating capacity is adequate even at the low bonnet temperatures of forced air heating plants in mild weather. . . . Fully automatic, simple, easily installed, reliable and reasonably priced. It is trouble-free . . . cannot clog with lime.

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NEW Model [ILLUSTRATED ABOVE] OPENS BIG MARKET

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This new self-contained model—simplified, more compact—presented at a considerable saving over the deluxe model, greatly enlarges the sales possibilities for dealers, jobbers and heating contractors.

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Don't be just a Sheet Metal Contractor all your life ——

Trane offers you an opportunity to become an established Air Conditioning Dealer.

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Here is a chance to build up your organization. A chance to make more profit. Trane is opening the field of Air Conditioning to the Sheet Metal Trade.

You can sell Trane Year Round Air Conditioning Systems. Systems that give control of winter air conditions as well as summer. An all season profit line.

Many are trying to break into Air Conditioning. Few are as well set up as the Sheet Metal man to handle the work. Here's your chance to take advantage of the situation.

There are 300 Trane representatives located in principal cities all over the country. Men who know Air Conditioning from the inside out. Men who know how to sell it, too. They will help you get started. Show you how you can get in on big profits.

Many Sheet Metal men have been small operators for years. When big jobs came along, the Sheet Metal man was often only a sub-contractor. His profit was on labor only. Now, Air Conditioning gives you a real opportunity.

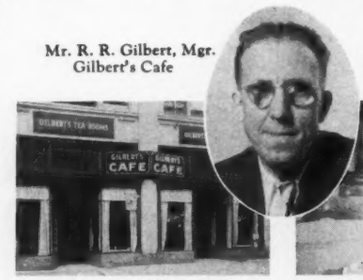
This great new Air Conditioning industry needs the Sheet Metal man. And Trane is ready to help you be the Air Conditioning authority in your territory. Your reputation as an Air Conditioning man will boost your heating business too.

As a Sheet Metal man, you are all set. From your heating experience, you understand the distribution of air. You have all the tools. No equipment to buy. No expenditure to make.

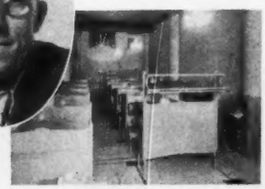
The Trane Company will work with you. Help in your sales. Help you select the correct equipment from the most complete line of Air Conditioners on the market. You have the chance to add the profits from material to your labor charges.

There is a big demand for Air Conditioning. Not only in summer, but the year round. It is fast becoming a downright necessity. Yet, it is still a young industry. All agree it will soon be the granddaddy of them all. Your foresight in getting into this field with Trane will pay plump dividends.

It's up to you to decide who will be the Air Conditioning expert in your territory. Write Trane for the complete story.



Mr. R. R. Gilbert, Mgr. Gilbert's Cafe



Gilbert's Cafe (below) Minneapolis, Minnesota

You Can Have Satisfied Customers Like Mr. Gilbert

The Gilbert Cafe, located across the street from Minneapolis' luxurious Minnesota Theatre, uses large Trane Water Cooling Coils to cool and dehumidify the air that is gently distributed throughout the Cafe. Fifty-two degree water is obtained from an artesian well located in a neighboring plant. This is used as an inexpensive cooling medium that eliminates service calls.

Mr. Gilbert, Manager of the Cafe, says he's for Trane Air Conditioning all the way. He claims his business has increased at least thirty-three per cent since the system has been in operation. Mr. Gilbert points to the fact that everything has functioned perfectly since the day the system was first put into operation.

To quote Mr. Gilbert: "We had some extremely hot weather during the middle of the summer, but were able to give our customers a cool, comfortable place for them to enjoy their meals. Their appreciation was shown by the increased number of customers and the larger size meal checks."

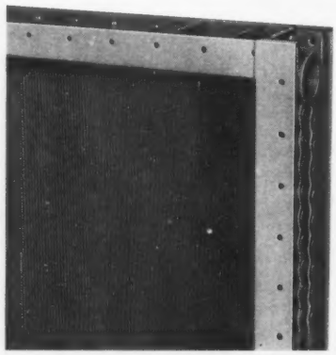
Satisfied customers like Mr. Gilbert are typical of Trane Air Conditioning users everywhere. Keep your customers satisfied by giving them Trane proved Air Conditioning Equipment.

The Trane Company

LA CROSSE, WISCONSIN

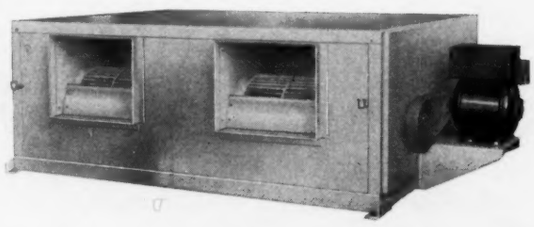
Over 60 U.S. Branches

In Canada: Mowat & King Sts., W. Toronto



THE TRANE CLIMATE CHANGER FOR YEAR ROUND AIR CONDITIONING

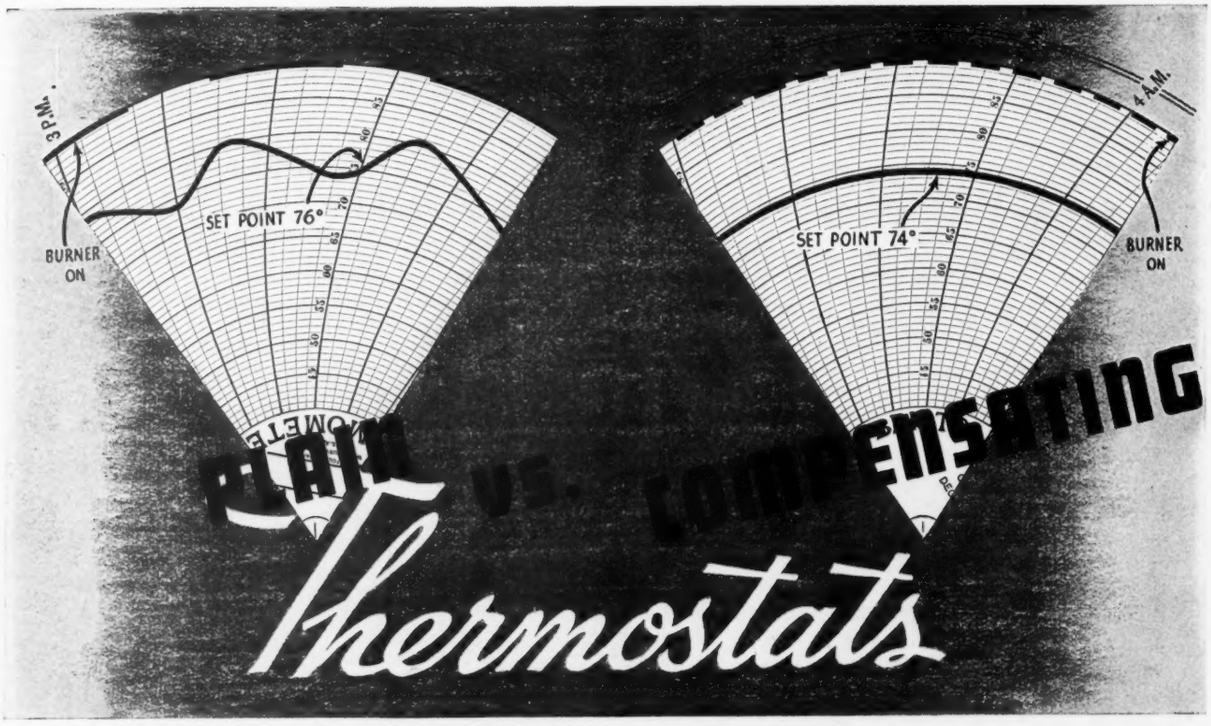
Available in a variety of sizes for installation in residences, stores, apartments and many other types of buildings. Trane manufactures a complete line of heating, ventilating and air conditioning equipment to meet every modern requirement.



The Trane Climate Changer

TRANE for *year round* Air Conditioning TRANE

HEATING SPECIALTIES • UNIT HEATERS • COPPER CONVECTORS • BLAST COILS • AIR CONDITIONERS

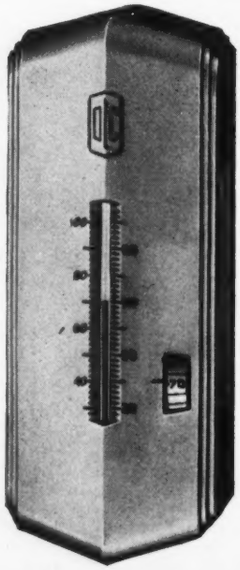


The Compensating Thermostat, as you know, differs from the conventional thermostat (for convenience here called the Plain Thermostat), in that it utilizes a small heater element to react on the blade, breaking the heating circuit before air temperature reaches the thermostat set point.

These two types (Plain and Compensating) were tested under identical conditions for comparative accuracy in maintaining room temperature at a given set point. Tests were run, not in the laboratory but in a residence occupied by a Detroit family.

The Plain Thermostat was set with laboratory precision—far closer than would be practicable in normal service. The temperature chart on the left shows exactly how this instrument behaves. Notice the total variation of 6°—2° under and 4° over the set point. Also, the length of the burner's operating cycle—approximately 70 minutes on and 15 minutes off. The heavy line at the top of the chart shows the periods during which the burner was on.

The Plain Thermostat was then replaced by a "Genuine Detroit" Two-Eleven Compensating Thermostat but without any other changes in the set-up. The temperature curve on the right shows how evenly room temperature was held by this instrument. At no time did it differ by more than half a degree from the set point. And instead of a few long operating cycles, there were a number of much shorter cycles . . . approximately 15 minutes on and 5 minutes off.



It is apparent that Plain Thermostat control produces high peaks in the temperature curve, which represent not only discomfort from over-heating, but an appreciable waste of fuel. Likewise, the valleys in this curve show periods of discomfort from under-heating. With Compensation both peaks and valleys, both discomfort and waste are eliminated.

With the Two-Eleven Thermostat you can have perfectly even temperature regulation as illustrated above. Or if for any reason you prefer longer heating cycles with some variation in temperature level, that is equally available. The Two-Eleven is the only unit which will give you any desired degree of compensation and heating cycle without changing the thermostat itself or some of its elements. Simple adjustment of the heater element provides this wide variation.

★ For complete details ask for Bulletin 86.

SUNBEAM

AIR-CONDITIONING UNITS—COMPLETE WITH BURNER—

AIR-CONDITION ANY HOME

Here are three Sunbeam Air Conditioning Units complete with oil burner to satisfy the needs of all your customers. In large homes, in small homes, or medium sized ones . . . one of these units will do the job. The oil burner is part of the unit, easily installed and insuring maximum efficiency.

For Large and Medium-sized Homes

The beautifully designed unit in the upper right hand corner is available in four capacities ranging from 100,000 to 175,000 BTU. per hour. It is Sunbeam Unit No. 224 with a gun type burner in front of the heating unit, inside the jacket.

For Smaller Homes

Two models of 720 series satisfy the air conditioning needs of smaller homes. They are equipped with a Wall Flame Type Burner that slides right into place, is installed with four easy movements. No. 720 R-9 is for homes without cellars. Notice how the blower unit fits in the rear under the smoke pipe to save space. No. 720 R-10 is for small homes **with** basements. These two units come in three capacities ranging from 60,000 to 95,000 BTU. per hour.

Units For Coal and Gas

In the complete line of Sunbeam Air Conditioners, there are two series of gas-fired and two series of coal-fired units. Capacities range from 74,000 to 300,000 BTU. per hour. Sunbeam Air Conditioners are available at short notice from jobbers located in all principal cities. Write for complete information today.

SUNBEAM
WARM AIR FURNACES AND AIR CONDITIONING UNITS

THE FOX FURNACE COMPANY, ELYRIA, OHIO
Division of American Radiator & Standard Sanitary Corp.

The Fox Furnace Company,
Elyria, Ohio.

I want full information about the three Sunbeam Air Conditioning Units complete with oil burners — also data on other series of air conditioners and furnaces for coal and gas.

Name.....

Address.....

City.....State.....

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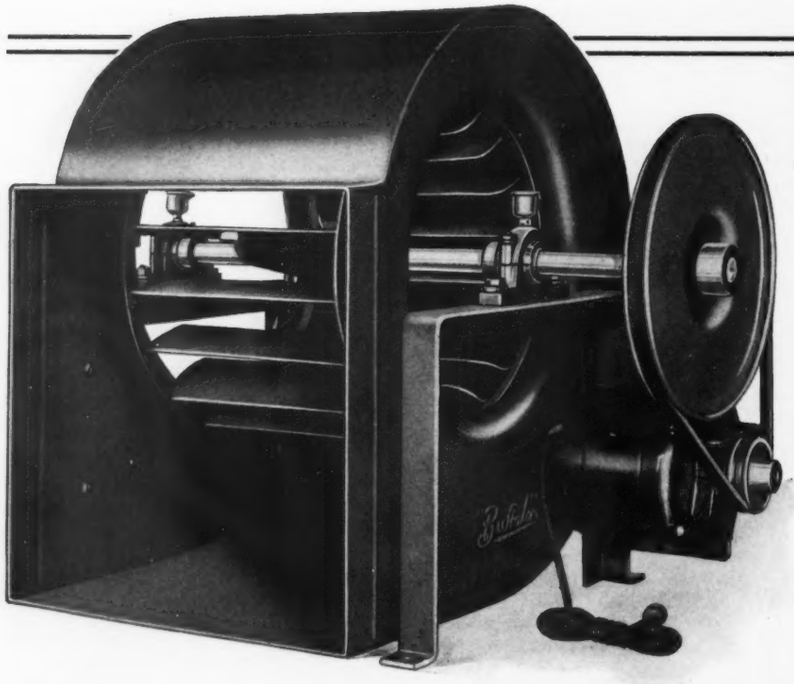

Can you afford NOT to sell this fan?

Your business depends on satisfying your customers. If you are installing forced warm air heating, or air conditioning, the most important part of the installation is the fan. Because it must deliver air up to rated capacity against varying resistances—the fan must be accurately rated. Because it must stand rough handling without damage, it must be sturdy. And finally, and most important of all, IT MUST BE QUIET!

We know that you can prove to your own satisfaction that Buffalo HVA Fans are the most satisfactory when checked against these three important requirements.

Two Sizes—For Immediate Shipment

Now they are available with a new rubber-cushioned noise isolating motor mounting, shown above. Moderately priced for the quality of the fan, these motor driven units will help you sell more jobs.

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"Buffalo" Type "H.V.A." Forced Circulating Fans

Forced Air Heating Facts From the Research Residence

By S. Konzo
Special Research Associate
Engineering Experiment Station
University of Illinois

Design of Forced-Air Heating Systems

Introduction

IN the preceding four issues of this magazine a method of designing a forced-air heating system has been explained in some detail. The author continues the discussion in this article.

The general procedure in designing a forced-air heating system may be itemized briefly in the following manner:

a. Determine heat loss from each room in B.t.u. per hour.
b. Locate all warm air supply registers and return grilles on the plans of the house, beginning with the upper story rooms.
c. Sketch in a tentative duct system to connect all the registers and grilles with the central heating unit.
d. Determine the equivalent length of duct leading to each register, allowing 10 diameters of straight pipe as equivalent to each 90-degree elbow, having an inner radius not less than the diameter of the round pipe or the depth of the rectangular pipe.
e. Select a value for the temperature of the air at the furnace bonnet. It is customary to use a value between approximately 150 deg. F. to 165 deg. F. In well insulated structures where a larger number of air recirculations is desired, a lower value for the bonnet air temperature may be found to be desirable.
f. Determine approximate value of temperature reduction of warm air in each duct, resulting from loss of heat from the ducts. Subtract these values of temperature reduction from the assumed bonnet temperature to obtain the values of register air temperatures for each warm-air supply duct.
g. With the aid of simple factors, which were tabulated in a previous issue, obtain the air volume required at each supply register. In this article the discussion will concern the selection of duct sizes and the fundamental principles governing determination of duct sizes.

Determination of Register Size

From the values of the air volumes to be delivered through each supply opening into the room, the register sizes can be determined. The data supplied in manufacturers' catalogues will enable a designer to select a given type of register to handle the required air delivery. Where such data are not available the following procedure may be followed:

$$\text{Required free area of register, in square inches} = \frac{144 \times \text{C.f.m.}}{\text{Velocity}} \qquad (1)$$

in which "free area" is the net opening, or the "daylight opening" of a register; "C.f.m." is the air volume to be handled by the register in cubic feet per minute; and "velocity" is the allowable register air velocity in feet per minute.

Unless otherwise specified the following allowable register air velocities may be used in equation (1).

Table I—Allowable Register Velocities

Location	Type	Allowable Velocity
Baseboard	Non-deflecting plain grille	Not over 300 fpm
Baseboard	Deflecting towards floor	Not over 500 fpm
Baseboard	Deflecting towards floor and diffusing outwards	Up to 800 fpm
High Sidewall	.....	Not less than 600 fpm

The use of larger values for the allowable velocity will result in small inconspicuous registers, but may result in a greater tendency towards draft in the room and increased resistance to air flow.

The gross area of a register, which includes the area covered by bars, grilles, and frame, is the area ordinarily specified in manufacturers' catalogues and may be determined by inserting values in the following equation:

$$\text{Gross area of Register, in square inches} = \frac{\text{Free Area}}{\text{Ratio}} \qquad (2)$$

in which "Ratio" is the numerical ratio of "free area" to "gross area." The values for the ratio range from

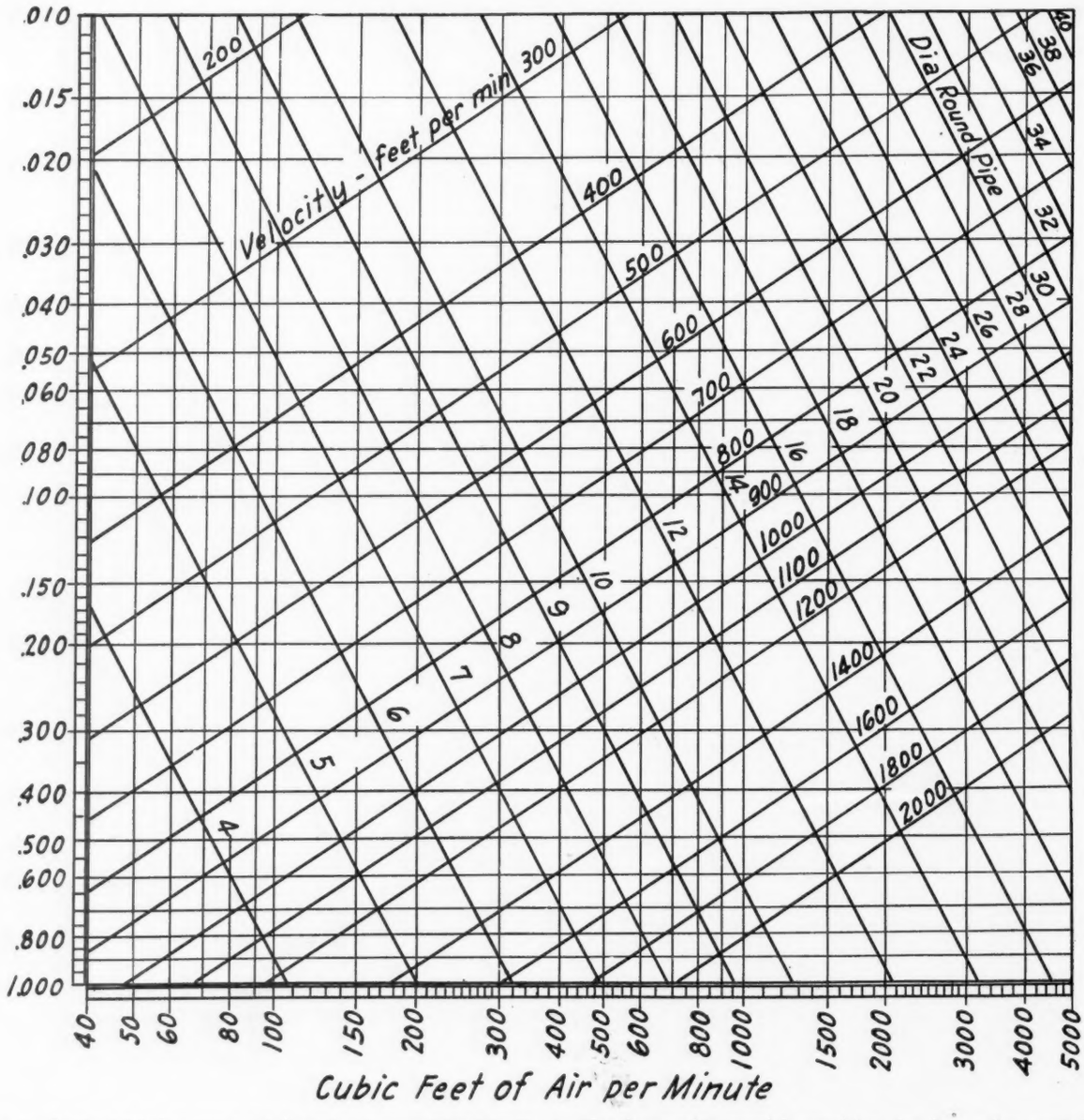

Fig. 2—Revised friction chart, originated and copyrighted by G. A. Voorhees with special provision for low c.f.m. and low pressure losses.

approximately 0.50 to 0.85 and are usually specified in manufacturers' catalogues.

Example 1

Warm air register to handle 212 cu. ft. per minute of air at a temperature of 135 deg. F. Baseboard register of plain grille type, in which the air is not deflected towards the floor, is to be used. What size of register is required, if the ratio of free area to gross area is assumed as 0.75?

$$\text{Free area} = \frac{144 \times 212}{300} = 101.8 \text{ sq. in.}$$

$$\text{Gross area} = \frac{101.8}{0.75} = 135.7 \text{ sq. in.}$$

The register may be 10 in. x 14 in., 12 in. x 12 in., 8 in. x 18 in., or 6 in. x 24 in.

Example 2

If in the above example a forced-air type register, which deflects the air towards the floor and diffuses it outward as well, is specified. What size register could be used?

If an allowable register velocity of 600 ft. per minute is used instead of 300 ft. per minute, as was assumed in Example 1, the gross area and register size will be half as large.

Example 3

Cold air return grille to handle 420 cu. ft. per minute of air at a temperature of 65 deg. F. Assume ratio of free area to gross area to be 0.5 and allowable velocity

to be 500 ft. per minute. What size grille will be required?

$$\text{Free area} = \frac{144 \times 420}{500} = 121 \text{ sq. in.}$$

$$\text{Gross area} = \frac{121}{0.5} = 242 \text{ sq. in.}$$

Use grille sizes either 6 in. x 40 in., 8 in. x 30 in., 10 in. x 24 in., 12 in. x 20 in., depending on space available for grille in sidewall or in floor.

Types of Duct Systems

The various types of duct systems may be grouped into the following general classification:

TABLE 2.

Classification of Duct Systems

1. As to Method of Design:
   - a. Velocity method
   - b. Equal pressure method
   - c. Modified methods
2. As to Type:
   - d. Trunk system
   - e. Individual duct system
   - f. Combination individual line-trunk system
3. As to Shape of Duct:
   - g. Round ducts
   - h. Square or rectangular ducts
   - i. Combination rectangular-round ducts
4. As to Special Features:
   - j. High velocity system
   - k. Overhead trunk system
   - l. Underground system
   - m. Loop system
   - n. Zoned systems

A detailed discussion of some of the items listed in the table will be presented in a later section. It is more appropriate at this point in the discussion to review very briefly a few of the general principles that are involved in the determination of the resistance to air flow in a duct carrying moving air. The general principles may be considered as consisting of:

a. Law of continuity
b. Bernouilli's theorem
c. Equation of pressure loss
d. Resistance of duct in series
e. Resistance of parallel ducts.

a. Law of Continuity

In a continuous duct the weight of air that flows past a given point in the duct is equal to the weight of air that flows past another point in the same duct, provided that there is no leakage of air and no diversion of the air from the duct between the two points. For example, in Fig. 1 the weight of air that flows past station 1 is equal to the weight of air that flows past station 2. It may be noted that if the temperature of the air at stations 1 and 2 are different, then the volumes of air that pass the two points will be different, although for small changes in temperature the differences in air volume may be negligible. In ordinary calculations the assumption is usually made that the air volume passing station 1 is the same as that passing station 2. Similarly, the assumption is usually made that the sum of the air volumes passing stations 3 and 4 is the same as that passing station 2. (Fig 1 on page 75.)

b. Bernouilli's Theorem

In the case of air (at low pressures) flowing in a duct, the total head at a given point in the duct is equal to the sum of the total head at another point in the same duct and the loss in pressure head that has taken place between the two points. This loss in pressure head may be accounted for by the loss due to the frictional resistance imposed by the walls of the duct to the moving air stream, and to the internal friction and turbulence in the air stream.

c. Equation of Pressure Loss

The loss in head, or pressure loss, in a duct which is carrying air is proportional to the roughness of the interior surface, the length of the duct, the perimeter of the duct, and is inversely proportional to the cross-sectional area of the duct. The loss of head, in terms of the height in feet of a column of air, may be defined by the general equation:

$$h_{air} = \frac{f\,L\,P}{A} \times \frac{v^2}{2g} \qquad (1)$$

in which,

h_{air} = loss of head, in feet of air column
f = coefficient of friction, determined from experimental data
L = length of duct in feet
P = perimeter of duct in feet
A = area of duct in square feet
v = average velocity of air flow in feet per second
g = 32.16 ft. per second per second

Ordinarily, the loss of head is stated in terms of "inches of water" rather than in terms of "feet of air column". The conversion in units can be made by means of the following identity:

$$h_{air} = \frac{h\,k}{12d} \qquad (2)$$

in which,

h = loss of head, in inches of water
k = density of water in manometer, 62.4 lb. per cubic foot for 70 deg. F.
d = density of air flowing, 0.075-lb. per cu. ft. for air at 70 deg. F.

Substituting the terms in equation (2) in the first equation,

$$h = \frac{12d}{k} \times f \times \frac{LP}{A} \times \frac{v^2}{2g} \qquad (3)$$

The following values may be substituted in equation

(*Continued on page 74*)

Converting Old Gravity Systems To Forced Warm Air

In remodeling old gravity systems, the inter-relation of register air temperature, basement pipe velocity and room air change must be kept in mind. As a result some one room is usually the critical room and must form the basis of design. The tables used with this article may be had in 8½ by 11 size.

By G. A. Voorhees
Indianapolis, Indiana

SINCE one of the many advantages of mechanical heating over gravity warm air heating, is that smaller pipes may be used and more head room thus provided in the basement this fact should be emphasized in making the sales presentation to the property owner.

From the heating contractor's standpoint, the benefits to be derived from complete replacement of the basement duct system when converting the plant from gravity to mechanical circulation are:

1. Greater profit. Any department store or specialty sales organization can sell a blower; then hire a jack-of-all trades to install it—provided the original duct system is left as it was. If the old pipes are torn out and new ones installed throughout, they must sublet this to a sheet metal worker. Therefore the radio and refrigerator dealer, the plumber and steamfitter who doesn't have a sheet metal shop, the electrical contractor and every other "outsider" who is trying to break into the air conditioning field, concentrates on the sale of blowers, thermostatic controls, humidifiers, etc., because those items are the most profitable *for him.* Those items are equally profitable to the warm air heating contractor. And in addition, he can make good money on the installation of complete new piping systems because he operates a sheet metal shop—an advantage which the other fellow doesn't enjoy. Hence, from the profit standpoint (and that's what we're in business for) the legitimate warm air heating contractor enjoys an advantage over the competitor who doesn't have a sheet metal shop, on any conversion job where the owner can be induced to have the old ducts replaced when the blower is installed.

2. Plant is easier to adjust. In the early days of fan heating, it took us a long time to find out that there is no such thing as a duct system which is equally effective for gravity and for forced circulation. We found that when a booster fan was added to a gravity plant, if we adjusted the dampers in the pipes to give each room its proper quota of heat when the fan was running, the heat distribution was thrown completely "out of balance" when the fan stopped; if we set the dampers for proper proportioning of the heat under gravity flow conditions, the whole plant was thrown out of balance when the fan started. In converting a plant from gravity to forced air, it is generally easier to adjust the dampers so that each room will get its correct allotment of heat if the ducts themselves are sized approximately according to the quantity of heat which each is to deliver. After the plant is in operation, if the user tampers with the damper adjustments (and he's quite likely to), there's less chance of his throwing the system out of balance if the pipes themselves are sized for forced rather than gravity flow.

3. Better appearance. If your customer is proud of his converted job, he'll talk about it to his friends and neighbors. If in addition to the blower and other accessories which you sell him, you replace the old, dirty, unsightly, gravity-size pipes with new, small, clean ducts, installed in a neat, workmanlike manner, your customer will not only talk, but he will take justifiable pride in showing the system which you have remodeled for him, to any one who is interested—a decidedly profitable sales help for you.

What Size Pipes?

If the old pipes are to be replaced, the question at once comes up: What size shall the new pipes be?

Space doesn't permit breaking this question down into its fundamentals in this brief article, but rules and formulas will be found in the Mechanical Warm Air Heating Code, Third Edition, a copy of which may be obtained by writing to the Editor of the AMERICAN ARTISAN.

Assuming that the reader is familiar with the Mechanical Heating Code, it is sufficient to say that sizing the ducts for any mechanical system consists essentially of two steps:

1. Calculating the Room Basic Factor (the heat loss of the room in thousands of B.t.u. per hour), for each room.

2. Selection from the accompanying Table 1 (which is an amplification of Table 3 of the Mechanical Heating Code), the factor by which to multiply the room basic factor, to determine the cross sectional area of the duct in square inches.

For the first of these steps, the Code gives complete instructions. It's the second step which is most likely to present difficulties because the Code lists eleven

different velocities and seven different register temperatures making a total of 77 possible combinations of temperature and velocity available.

Register Temperature and Velocity

Just which combination of register temperature and velocity is most desirable, cannot be answered definitely. There is no agreement among experienced heating contractors, engineers and manufacturers of heating equipment as to any one "best" combination. It is therefore suggested here, that if the original duct system is to be replaced, the new supply ducts be of such sizes that they will heat the rooms whenever possible with register temperatures ranging from 140 to 150 degrees and with air velocities in the leaders and risers ranging from 450 to 550 f.p.m.

The register temperatures suggested are for plants using coal fired furnaces; for oil or gas lower temperatures with correspondingly larger air volumes are often recommended. The suggested velocities are for plants having separate ducts from the furnace bonnet to each room. In trunk line systems, the velocities suggested above, would be for risers to second floor rooms and for horizontal branches from the basement trunk line; the trunk itself could carry air at higher velocity and would do so if sized by the percentage reduction method given in the Mechanical Code.

The foregoing suggestions should not be taken to mean that the remodeled plant should never be designed for register temperatures lower than 140 degrees or higher than 150 degrees; nor that the air velocities

TABLE I
FACTORS FOR C.F.M. AND PIPE AREAS
BASED ON MECHANICAL HEATING CODE 3RD ED.

Register Temp. Deg. Fahr. →	130	135	140	145	150	155	160
C.F.M. Factor →	14.2	13.2	12.3	11.6	10.9	10.3	9.75
Air Velocity F.P.M.	Pipe Area Factor						
300	7.7	7.2	6.7	6.3	5.9	5.6	5.3
325	7.1	6.6	6.2	5.8	5.5	5.2	4.9
350	6.6	6.2	5.7	5.4	5.1	4.8	4.5
375	6.2	5.7	5.4	5.0	4.7	4.5	4.2
400	5.8	5.4	5.0	4.7	4.4	4.2	4.0
425	5.5	5.1	4.7	4.4	4.2	3.9	3.7
450	5.1	4.8	4.5	4.2	3.9	3.7	3.5
475	4.9	4.5	4.2	4.0	3.8	3.5	3.3
500	4.6	4.3	4.0	3.8	3.5	3.3	3.2
525	4.4	4.1	3.8	3.6	3.4	3.2	3.0
550	4.2	3.9	3.7	3.4	3.2	3.0	2.9
575	4.0	3.7	3.5	3.3	3.1	2.9	2.8
600	3.9	3.6	3.3	3.1	3.0	2.8	2.6
625	3.7	3.4	3.2	3.0	2.8	2.7	2.5
650	3.6	3.3	3.1	2.9	2.7	2.6	2.4
675	3.4	3.2	3.0	2.8	2.6	2.5	2.3
700	3.3	3.1	2.9	2.7	2.5	2.4	2.3
725	3.2	3.0	2.8	2.6	2.4	2.3	2.2
750	3.1	2.9	2.7	2.6	2.4	2.2	2.1
775	3.0	2.8	2.6	2.4	2.3	2.1	2.0
800	2.9	2.7	2.6	2.4	2.2	2.1	2.0

Fig. 1—The table above is an extension of Table 3 of the Mechanical Heating Code. To use, select register air temperature and air velocity (basement pipe); where these meet find a factor which multiplied by R.B.F. will give pipe area.

in risers and leaders must be kept within the limits of 450 f.p.m. and 550 f.p.m. Those are merely the limits for which the majority of experienced forced air heating men show a preference.

Temperature and Velocity Suggestions

They are the temperature and velocity ranges within which these men consider it *desirable* to design when conditions permit. But when one enters the remodeling field, many a revamped plant will have to be designed on a basis which is not ideal. To the heating contractor who lacks experience in forced air heating, this advice may be given:

1. Try to design your mechanical systems for air velocities not exceeding 500 f.p.m. in basement leaders and risers, and for register temperatures not higher than 145 degrees.

2. If it becomes necessary to go beyond 500 f.p.m., remember that the "static pressure of the system" (the pressure which the blower must develop to move the air) increases at a much higher rate than the increase in velocity. For instance, if the air velocity in a given duct is stepped up from 450 f.p.m. to 600 f.p.m., the increase in velocity is only 33⅓%, but the corresponding increase in friction pressure loss or "static pressure" due to this 33⅓% increase in velocity, is in the neighborhood of 75%. Hence, be especially careful to avoid the use of undersize or inaccurately rated blowers on jobs where relatively high air velocities may be required.

3. If duct velocities beyond 600 f.p.m. or register temperatures higher than 150 degrees, seem necessary, get the advice of someone experienced in mechanical heating before designing the plant.

Such information and advice is available from equipment manufacturers or consulting engineers.

These suggestions regarding the sizing of ducts for mechanical heating systems in general, are likewise applicable to conversion jobs *provided* the existing wall stacks are large enough. Unfortunately the old risers may not only have been entirely too small to heat the second floor rooms by gravity circulation, but they may not even be large enough for mechanical heating unless the plant is designed on the basis of higher register temperatures and higher duct velocities than we would use for plants we are installing in new houses where we could specify the sizes of risers.

Owner Must Decide Cost

Unless the owner is willing to go to the expense of additional risers we must choose between two alternatives: Either (1) design the new system on the basis which we prefer to use and if it doesn't provide enough heat for the second floor rooms, tell the owner in advance that the remodeled system will *improve* the heating of second floor rooms, but cannot be guaranteed to heat them to 70 degrees in midwinter; or (2) discard our "preferred" design basis and size the new duct system for a combination of register temperature and duct velocity which will provide sufficient heat for the upstairs rooms.

If we choose the latter, *how* are we to know *what design basis to use?*

(*Continued on page* 68)

Air Filters in Air Conditioning Systems* [Part 2]

By Frank B. Rowley
Professor of Mechanical Engineering
University of Minnesota

THE results which may be expected from any type of filter will naturally vary over a wide range, depending upon the specific properties of the filter and the operating conditions. In order to give comparative ratings the American Society of Heating and Ventilating Engineers has adopted a standard test procedure. A uniform dust mixture is selected consisting of 50 per cent by weight of carbon black and 50 per cent of Pocahontas ash passed through a 200 mesh screen. This dust is mixed into the air stream leading to the filter at a uniform rate, the arrestance and pressure drop across the filter being recorded throughout the test. The test results are plotted on coordinate paper with time and rate of dust feed as abscissas and arrestance and pressure difference across the filter as ordinates. Tests by this method are accelerated tests with a specific type of dust which may not in all cases correspond to operating conditions but the results do show a comparison between different filters, and in general show the characteristics of individual types.

Filter Tests

Figures 1 to 7 show the results for a series of filters tested by this method. The filters of Figs. 1 and 2 are strictly of the dry type in which the mesh is sufficiently fine to screen out reasonable proportions of the dust. Filter 3 is of a dry fibrous material of a coarse mesh, such that the dust could easily pass between the fibers. Filters 4, 5, and 6 are of a viscous-coated fibrous material, in which the dust is taken out by adhering to the fibers of the filter. Filter 7 is of a cellular type in which the walls of the cells are coated with a viscous material and the dust is removed by impingement against these walls. The results of these tests show typical characteristics which may be expected of each type.

*Paper presented at the First Annual Conference on Air Conditioning, held at University of Illinois, May 4 and 5, 1936.

Cloth Filter

Referring to the filters used in Test 1, the filtering material consisted of a rather close mesh felt cloth approximately $\frac{1}{16}$ of an inch thick, and weighing 7 ounces per square yard. The filter cloth was placed in a filter frame 6 inches deep, and plaited as shown in the accompanying figure. The spacing between the plaits was such that the actual exposed area of the filter cloth was twenty times the cross sectional area of the filter duct, thus giving an air velocity through the filter proper of 12½ feet per minute. Two filters were tested, and the results shown by the curves are typical for filters of this type. The dust arrestance is very good. The air pressure drop across the filter is high, and the dust-holding capacity is low. The efficiency increased during the test due to the fact that the pores or openings between the fibers gradually became smaller, and thus stopped more of the dust. This reduction in the size of the openings is also indicated by the rapid rise in resistance to air flow through the filter. A filter of this type would be practical where a high efficiency is desired, where the total amount of dust to be handled is small, and where a high pressure drop may be allowed across the filter. As will be shown later a filter of this type will in general give increased efficiencies and reduced pressure drop through the filter as the air velocities are reduced.

Cotton Batting Filter

The filter from which the data for Fig. 2 was obtained is a dry type of filter built up of a layer of

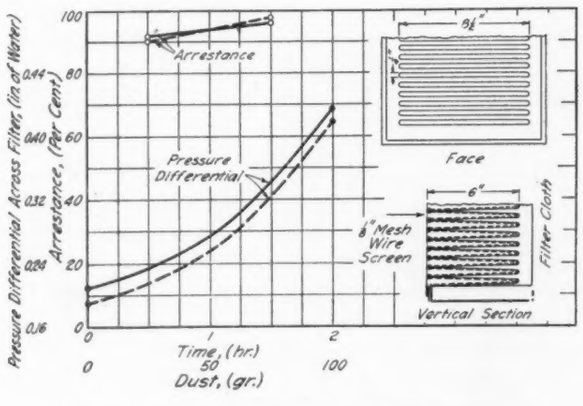

Fig. 1. Results With Felt Cloth Dry Filter.

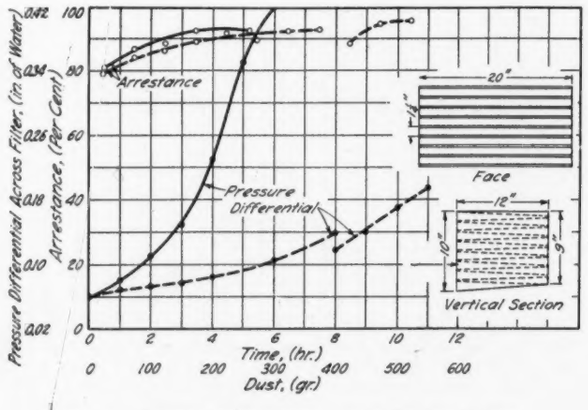

Fig. 2. Results With Cotton Batting Dry Filter.

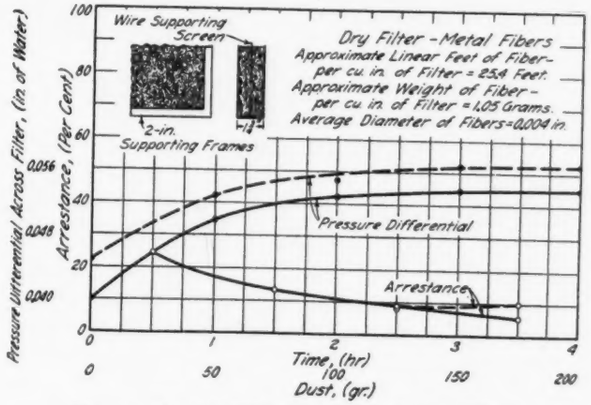

Fig. 3. Results With Metal Wool Dry Filter.

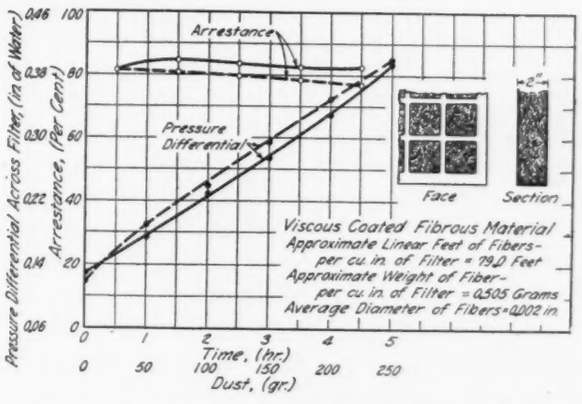

Fig. 4. Results With Viscous Coated Fibrous Filter.

cotton batting approximately ¼ inch thick. This cotton material was of a loose fiber on one side, but the other side was more densely matted and glazed. The material was plaited in a frame 12 inches deep, with the plaits approximately 1¼ inches apart thus giving an actual filter area of 19.2 times as much as the cross sectional face area of the filter. Thus the actual velocity of air through the filter was 13 feet per minute. This filter was tested with the air passing through in each direction. The solid line curves represent the results obtained when the air entered the filter media from the glazed side and the broken line curve represents the results obtained when the air entered from the loose matted side. The break in the broken line was due to the fact that the filter stood over night after the first 8 hours of test, and the results for the first hour in the morning did not check with the extended curve for the previous results. This was found to be true in the case of many viscous filters and makes it necessary, in so far as direct comparisons are concerned, to run a filter rating test either continuously or else at uniform and equal intervals. The interesting comparison between the two tests on this filter is found in the rapid rise in pressure drop across the filter for the test in which the air enters from the glazed side of the cotton as compared with the pressure drop for the test when it enters from the opposite side. This is due to the fact that the

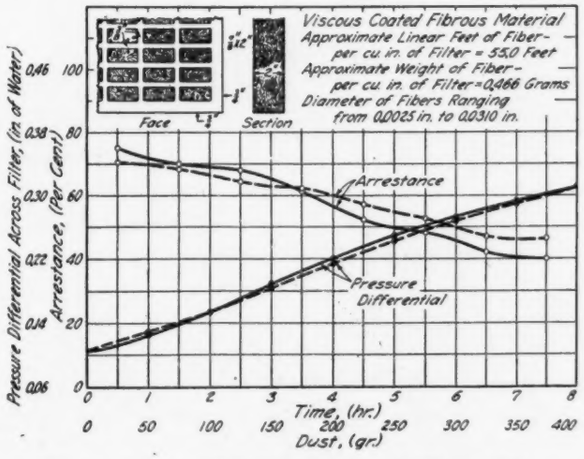

Fig. 5. Results With Viscous Coated Fibrous Filter.

fine mesh of the fibers on the glazed side was most effective in screening out the dust particles, and when the air entered from this side the fine openings soon loaded up with dust and raised the pressure differential. When the air entered through the loosely-packed fibers a part of the dust was taken out by these fibers, and the capacity of the fine mesh fibers was reserved for the final filtering of the air. This principle of progressively increasing the density of fiber pack as the air passes through the filter is commonly used in the viscous-coated type. The differences in efficiencies between the two tests on this filter are not great, but the performance is very much better when passing the air through in the proper direction. In either test the arrestance is less than for the felt material of filter No. 1, but the dust-holding capacity is very much greater, and for the second test the pressure drop at the end of 11 hours was approximately the same as that at the beginning of the test of Fig. 1.

Metal Wool Filter

The filter used for Test No. 3 was built of metal wool loosely packed in the dry form. This material was coarse, loosely packed, and furthermore it was used as one flat sheet perpendicular to the air stream and not corrugated or plaited as filters Nos. 1 and 2, thus giving an air velocity through the filter of 250 feet per minute. The combination of coarse, loosely packed dry fibers and high air velocities make such an arrangement practically useless as an air filter. The results, as shown in the curve, indicate a low pressure drop and an impractically low arrestance. The results are valuble only in that they show how filters should not be designed.

Viscous Coated Fibre Filters

Figures 4, 5, and 6 show the results from tests of viscous-coated fibrous filters. They are all approximately 2 inches thick with fiber sizes and density of fiber pack as given on the data sheet. A comparison of test results for these filters shows that for filter No. 4, which had the most densely packed and finest fibers, the arrestance was higher and the air pressure drop was greater across the filter than for filters Nos. 5 and 6, for which the fibers were coarser and more loosely packed. The rise in re-

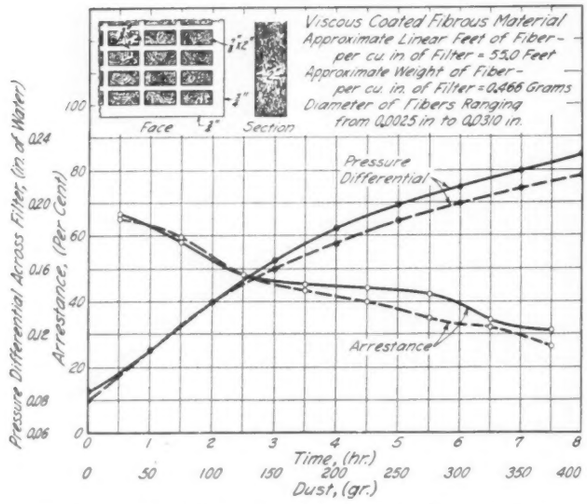

Fig. 6. Results With Viscous Coated Fibrous Filter.

sistance throughout the test for No. 4 was also greater than for either of the others. In filter No. 6 the fibers were more loosely packed than in filter No. 5; the arrestance and pressure drop were also less for filter No. 6. In general it may be said that for the same air velocities through the filters the arrestance depends upon the fiber size and density of pack. The denser the filter the higher the resistance, and also the higher the pressure drop, with a corresponding reduction in dust-holding capacity.

The velocity of air passing through the filters in Tests 4, 5, and 6 was 250 feet per minute and, as will be shown later a reduction in velocity would likely have increased the efficiency. Low velocity is one reason for the better showing of the dry filter of Fig. 1, although in this filter air resistance was very high even with the low air velocity. The efficiency of the viscous-coated filter of Fig. 4 compares very favorably with that of the dry filter of Fig. 2, although the air resistance for the filter No. 4 increased much more rapidly than that for filter No. 2. The actual face area of filter No. 2 was, however, nearly twenty times as great as that for No. 4.

Cellular Filter

The curves of Fig. 7 show the results for tests on a cellular type of filter in which the walls of the cells were coated with oil. In this case the dust particles were taken out by impinging the air

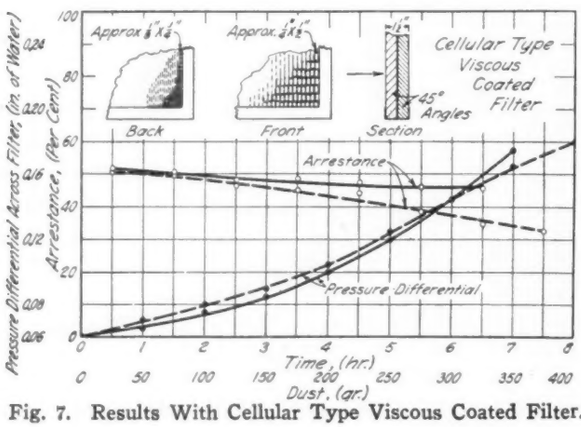

Fig. 7. Results With Cellular Type Viscous Coated Filter.

against the walls of the cell as the air passed through them. The air resistance of this filter was low, and likewise the efficiency was low. More impinging surfaces would have improved the efficiency and likewise increased the pressure drop.

Pollen Removal Efficiencies

Some of the variations which may be expected from the different treatments of filter materials are shown in the test results of Table 1. These test results were obtained by using lycopodium powder as a dust in the air. Lycopodium corresponds very closely in size and characteristics with some of the pollens which produce hay fever and the particular object for these tests was to find the efficiency of the various materials in removing such pollens.

TABLE 1

Comparative Test Results Obtained from Air Filters for Different Materials and Different Air Velocities When Using Lycopodium as a Dust

Test No.	Filter Material	Thickness in.	Air Vel. Thru Filter ft. per min.	Pressure Drop Thru. Filter in. water	Arrestance
1.	Cotton batting	½	131.4	1.7	85.4
2.	Cotton batting	½	73.5	0.73	85.4
3.	Cotton batting	½	38.	0.37	92.6
4.	¼-in. layer of absorbent cotton sprayed with oil	½	34.2	0.40	99.
5.	¼-in. layer of absorbent cotton sprayer with oil	½	62.	0.62	99.8
6.	¼-in. layer of absorbent cotton split in two parts and oiled	¼	34.2	0.14	98.4
7.	¼-in. layer of absorbent cotton split in two parts and oiled	¼	62.	0.40	94.
8.	Felt pad, same material as for No. 1	..	34.2	0.14	89.
9.	Felt pad, same material as for No. 1	..	68.	0.35	59.
10.	Same as No. 8 with filter oil added	..	34.2	0.19	95.
11.	Same as No. 8 with filter oil added	..	62.	0.45	96.
12.	⅛-in. felt cloth	..	66.6	0.42	89.
13.	⅛-in. felt cloth	..	32.7	0.22	96.
14.	Same as No. 12, sprayed with oil.	..	34.0	0.22	98.
15.	Upholstering moss 4-in. thick, wt. equals 0.365 lb	..	124.	0.07	84.
16.	Upholstering moss 8-in. thick, wt. equals 0.781 lb., oil added	..	124.	0.11	98.6
17.	Upholstering moss 8-in. thick	..	69.	0.05	98.8

The efficiency was determined by taking a dust count of the air entering and leaving the filter by the Smith-Greenberg method. The significant points to be noted in the results are the variations in air resistance and arrestance with air velocities and for different treatment of the fibers. The efficiencies of dry cotton batting filters ½ inch thick for varying air velocities are shown in Tests 1, 2 and 3. From these it will be noted that, as the air velocities vary from 131.4 feet per minute down to 38 feet per minutes, the air pressure drop through the filters varies from 1.7 down to 0.37 inches of water, and the arrestance increases from 85.4 to 92.6. This same relation is shown by comparison of Test 4 with Test 5, Test 6 with Test 7, Test 8 with Test 9, Test 12 with Test 13, and in practically every case a reduction in velocity increases the efficiency of the filter and lowers the air resistance. It is thus evident that velocity is a very important factor in the efficiency and operation of filters of this type.

Effect of Oil Spray

Next consider the effect of spraying the fibers with some type of viscous oil, the other conditions

(*Continued on page* 64)

Humidity in House Heating*

[Part 1]

Introduction

MANY people believe that excessive "dry air" conditions in house heating are to be found only in those houses heated by warm air furnaces, but the fact is that this type of heating equipment is practically the only one in common use in which provision is made to moderate such conditions.

The moisture capacity of air increases with rising temperatures. Thus cold air saturated with moisture becomes "dry air" when heated—not because moisture has been removed but because of its additional moisture capacity.

Under natural heating conditions the large water surfaces of the earth and the moisture from vegetation are the principal sources from which the increased moisture capacity of the heated air is sufficiently satisfied to obviate "air dryness"—except in the deserts, where the heated air remains dry.

Very material progress has been made since primitive times in the design of artificial heating equipment —from the smoky open fire in the middle of the floor of each chamber to the efficient modern centralized furnace or boiler equipment. But it is only within recent years that the question of maintaining healthful air-moisture conditions in houses has received serious attention. With comparatively few exceptions "dry air" indoor conditions are the rule—alleviated by chance evaporation of water in kitchen and other household operations and in some cases by the special evaporation of inadequate quantities of water in water pans, etc., but also usually intensified by the admission of large quantities of cold outdoor air through open windows to secure adequate ventilation.

It is true that the human organism adapts itself to such "dry air" conditions with little apparent discomfort, but in so doing it becomes susceptible to colds, sore throat, influenza, skin troubles, and other ailments through the weakening of tissues abused and overworked by an unnatural atmospheric condition.

The question of the maintenance of precise conditions of temperature, humidity, and air cleanliness as demanded by certain industrial processes has been thoroughly investigated, and as a result various types of effective air-conditioning apparatus have been evolved and are in general use in such industries. Similar equipment has recently been made available for use in theatres, hospitals, schools, and large office buildings, and no doubt will eventually be simplified and adapted to the needs of the small house.

In the absence of such complete air conditioning equipment which will secure to the householder healthful indoor temperature, humidity, and air cleanliness, it is extremely desirable that the present injurious "dry air" conditions be remedied by the use of special humidification devices such as are at present available.

Air Moisture: Relative Humidity

The air which envelops the earth and forms the atmosphere is a mixture of oxygen and nitrogen with varying quantities of water vapor, dust, and other substances. Water vapor is always present in quantities which depend principally upon temperature, winds, and the character of the earth's surface.

The quantity of water vapor which air can hold, or its moisture capacity, varies with the temperature. Raising the temperature increases the moisture capacity while lowering the temperature reduces it, the excess moisture condensing to form fog or mist as when the outside door of a warm room is opened on a very cold day.

For example, the air required to fill an average size living room 13 feet by 20 feet with a 9-foot ceiling (2,340 cubic feet) at zero Fahrenheit can hold moisture to the extent of only one-eighth of a pint of water, whereas at 30 degrees it can hold half a pint and at 69 degrees practically two pints, or sixteen times as much as at zero (Figure 1).

Fig. 1—The moisture evaporative requirements of an average room are graphically shown in this illustration.

*A booklet by the same name, published by the Resources Intelligence Service, Department of the Interior, Canada, in cooperation with The Dominion Fuel Board. Reprinted by permission.

Saturated air, or air that is charged with all the moisture it can hold, becomes therefore only partly so when heated, and in that condition absorbs further moisture if such is available until its capacity at the new temperature is fully satisfied.

The relation between the actual moisture content of the air at any temperature and its capacity for holding moisture at that temperature is known as its "relative humidity." It is expressed in percentage, and is thus a convenient expression to denote the intensity of the thirst of air for water, since the lower the relative humidity the more rapidly will moisture be absorbed.

The average relative humidity of air over the land surface of the globe is probably about 60 per cent, whereas that over the oceans is about 85 per cent. In the settled portions of Canada the relative humidity during the period of artificial heating varies from about 70 per cent to 100 per cent, the higher values being usually found with low and descending temperatures.

Cause of Air Dryness

Air is said to be dry when its relative humidity is low, that is, when its capacity for moisture is largely unsatisfied. Death Valley in California with an observed relative humidity of 23 per cent has one of the driest atmospheres of North America.

The outdoor temperature for a large part of the Canadian winter is well below the freezing point and the relative humidity is usually high—100 per cent at times.

Cold air with high relative humidity, but actually containing little moisture, is thus constantly circulating through the houses, displacing the warm air therein, being itself warmed and finally displaced by other incoming cold air at a rate of one, two, or more changes per hour, depending on ventilation, air leakage and infiltration, wind velocities, etc. Raising the temperature of such cold humid air from say 15 degrees, which is not an unduly severe winter temperature, to an indoor temperature of 69 degrees increases its moisture capacity eight times. Thus, assuming the outdoor relative humidity to be 100 per cent and that no moisture is added as the temperature is raised, the new relative humidity would be only 12½ per cent, which is considerably lower than that of the driest outdoor atmosphere of the continent as already noted.

It is apparent from the foregoing that (*artificial humidification must accompany artificial heating if dry air conditions are to be obviated*).

Effect of Air Dryness

The American Society of Heating and Ventilating Engineers has carried out extensive researches relating to the comfort or feeling of warmth experienced by the average person under varying conditions of temperature and relative humidity. The results of these researches are definite, showing that the same degree of comfort is experienced in air at 68 degrees with a relative humidity of 50 per cent as at 72 degrees with a relative humidity of 10 per cent.

The lower temperature required with the higher relative humidity for comfort would mean an appreciable economy in fuel consumption for purely heating purposes. A considerable portion of the fuel thus saved would, however, be required to evaporate the water necessary to secure and maintain the higher relative humidity. It has been stated that the net saving in fuel amounts to 5 per cent or more. Reliable information on this point is, however, not yet available.

Health

Dry air at the usual room temperatures is injurious to health. It tends to dry up the mucous membranes of the nose, throat, lungs, weakening the resistance of these organs to the disease germs carried in large part by the dust which it is an important factor in creating. It has a drying and harshening effect on the hair and skin. The excessive evaporation of moisture from the skin in dry air with its abnormal loss of heat requires the maintenance of high temperatures for warmth. Authorities point out that these high temperatures produce an enervating effect and cause nervousness and irritability.

Woodwork and Furnishings

Dry air has also a most injurious effect on the interior woodwork of houses and on furniture, abstracting the normal moisture content from the wood and causing it to shrink and check. It is destructive to paintings. It also contributes materially to the disintegration of textile fabrics used for clothing and furnishings—the fibres of which on loss of normal moisture become brittle, breaking into fluff and dust particles.

What Relative Humidity?

Medical authorities in general agree that a relative humidity of at least 40 per cent is necessary for health under the usual conditions of artificial heating. It is found that with the severe winter temperatures excessive frosting or condensation of moisture takes place on the windows (even when double windows are used) when the relative humidity runs above 50 per cent.

Thus practical considerations fix relative humidities of from 40 to 50 per cent as being the most desirable.

Very high relative humidities are as undesirable in artificial heating as they are in warm summer weather. They cause sultriness and stuffiness, prevent normal evaporation of moisture from the skin, and weaken bodily resistance to sudden changes of temperature in going from warm humid air to sharp outdoor winter atmospheres. They cause excessive condensation of moisture on the walls, encourage fungus growth and mildew, and they hasten the corrosion of iron and steel fittings and utensils as well as the decay of woodwork.

Prevention of Air Dryness

The prevention or obviation of air dryness in houses is simply a question of providing sufficient moisture to satisfy to the desired degree the increased moisture capacity of air brought about by artificial heating.

The quantity of water which must be specially supplied for the maintenance of an indoor relative humidity of from 40 to 50 per cent during the heating season depends upon several variable factors among which may be mentioned:

1. Outdoor temperature.
2. Outdoor relative humidity.

(*Continued on page* 63)

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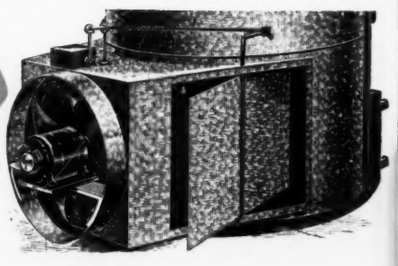

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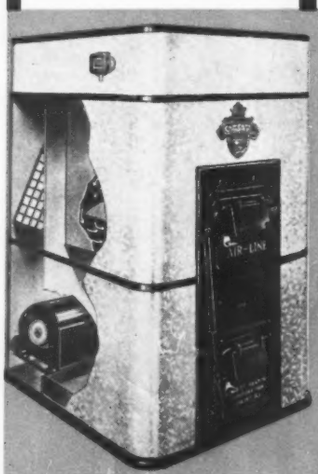

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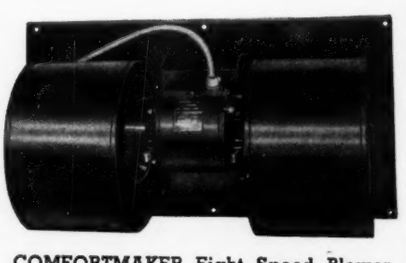

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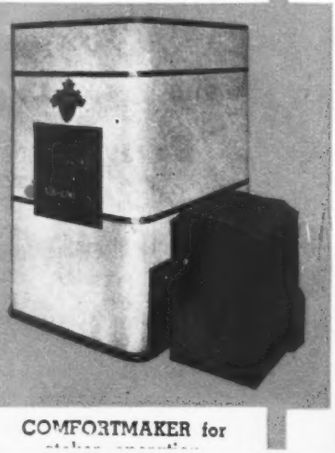

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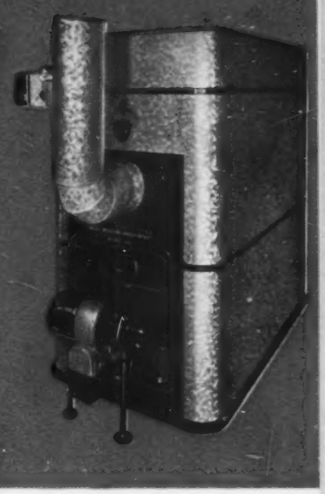

COMFORTMAKER designed for gun or pot type oil burner.

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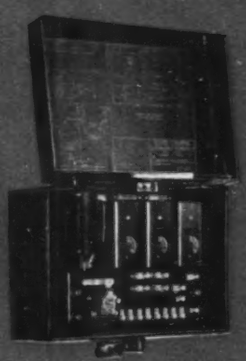

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Rigid Insulation

By Paul D. Close

WITH the many types of insulating materials now on the market, the layman is frequently at a loss to know which to select for his particular requirement. One type may be especially adapted to certain conditions, whereas another may be used to better advantage for other conditions. In this article, two of the most common types of insulating materials are compared, the rigid or board form, and fill insulations.

Rigid insulations are usually manufactured in sheets 4 feet wide and 6 to 12 feet long and in thicknesses of ½", ¾", $\frac{25}{32}$", 1" and multiples of ½. Smaller sized units are also made for special purposes such as plaster base, roof insulation and for decorative purposes. This type of insulation is manufactured from various raw materials including bagasse (cane fiber), wood pulp, straw, etc. Rigid insulations may be used structurally as sheathing, plaster base or interior finish as well as for insulating purposes, or they may be used solely as insulation in conjunction with other structural building materials.

Fill insulations, as the name implies, are used or applied in such a manner as to fill spaces, such as between wall studs, joists, rafters, or furring strips. Materials of this character were used many years ago, especially in cold storage work. These consisted mainly of saw dust, shavings, and certain mineral substances. The materials referred to were abandoned to a large extent because of settling, lack of homogeneity, and (especially in cold storage work) the tendency to take up moisture, and other factors.

Some Past History

From 1920 to 1930 certain types of gypsum products were used extensively as fill insulations. These included flaked gypsum which was applied usually by pouring between the studding in a dry condition and cellular gypsum which was applied between the studding as a hydrated gypsum mix in a wet condition, the cellular construction being derived from the effervescent process which took place as the result of a chemical reaction. At a later date, mineral wool products of various types were introduced. These included rock wool, glass wool, expanded vermiculite and various other fill-type materials.

The efforts of manufacturers and sales agents of the fill insulations have been augmented in certain sections by the recommendations of gas heating interests, including the manufacturers and sales agents of gas heating appliances, as well as the utility companies. In order to make practical the use of gas fuel and gas heating appliances, these organizations have sought to have the maximum possible thickness of insulation installed. This is particularly true in manufactured gas areas, where the unit cost of the fuel is exceptionally high. The combined efforts of these gas people and of the fill insulation manufacturers have in some cases tended to oversell the public on the insulation requirements of dwellings, or at least to convey the impression that greater thicknesses of insulation are always necessary and economically feasible, regardless of the type of construction, the kind of fuel to be used, or the conditions involved.

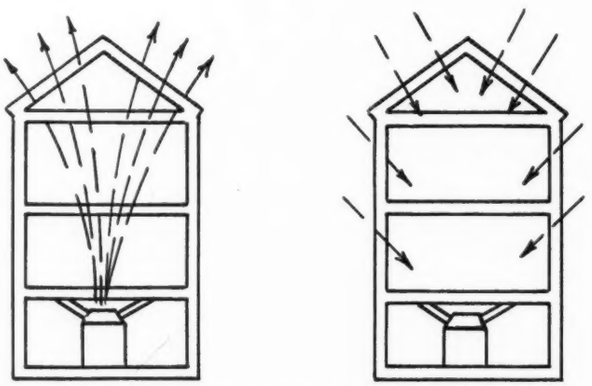
Purpose of Insulation

The purpose or function of heat and "cold" insulations is sometimes misunderstood. Everyone knows that heat is transmitted through any wall, floor or ceiling when there is a temperature difference between the two sides, the direction of heat travel of course being from the warm temperature through the structure to the cold temperature. In the winter the heat obviously travels from the inside of the building to the outside, whereas in the summer the heat transfer is in the opposite direction. See illustration below.

The *rate* at which heat passes through the walls, etc., depends somewhat on temperature difference, but to a much greater extent on the character of the materials used in the structure. The amount of heat transmitted, however, depends on the temperature difference. Hard, dense materials, such as brick, stone, metal, etc., have a tendency to transmit heat rapidly, whereas insulating materials transmit heat very slowly. In other words, an insulation resists or retards the passage of heat through a wall, so that in the winter the heat is retained for a greater period of time and less heat is required to maintain the desired temperature. Contrary to popular opinion, no material is an absolute heat stop; no material will stop 100 per cent of the heat from being transmitted through the wall or through any part of the building structure, although it is common practice to speak of insulation "stopping" a certain percentage of the heat.

Measure of Heat Transfer

In order to make comparisons between various types of construction with and without insulation, it is neces-



In the winter heat generated by the heating plant escapes through the walls while in summer heat from outdoors seeps in through walls. The transfer is from warmer to colder air temperatures

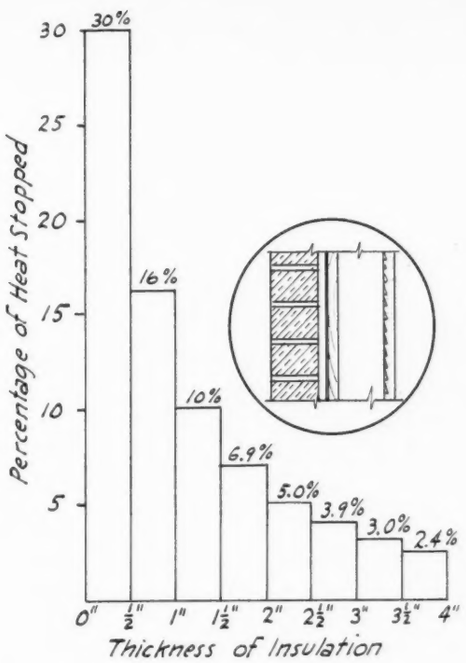


Figure 1[a]. Chart showing insulating effect of successive thicknesses of insulation when added to standard brick veneer construction.

[a]This chart is intended to illustrate the principle of diminishing return of successive ½" thicknesses of insulation *added* to the brick veneer wall shown in the inset. If 1" rigid insulation is used in place of the wood sheathing and ½" rigid insulation is used in place of the metal lath, the coefficient of transmission of the wall will be 0.15 and the reduction in the rate of heat transfer will be 46.4%. On the other hand, if 3⅝" fill insulation is used between the studding, the theoretical coefficient of transmission will be 0.062 and the theoretical reduction in the rate of heat transfer will be 77.8%.

sary to know the rate of heat transfer through each. The rate at which heat will pass through a wall or any other part of a building structure, is expressed by a factor known as the coefficient of transmission. For example, according to the American Society of Heating and Ventilating Engineers Guide, 1936, the coefficient of transmission of a standard uninsulated frame wall, with a brick veneer exterior finish is 0.28, which means that this number of heat units (Btu) will pass through each square foot of the wall in one hour for each degree difference in temperature. If the temperature difference is 10 degrees, the heat transfer would be 10 x 0.28 or 2.8 Btu per hour and if the wall area is 1000 square feet, the heat transfer will be 1000 x 2.8 or 2800 Btu per hour.

Diminishing Return

As stated above, comparisons between various types of walls with and without insulation are made on the basis of their coefficients of transmission, the lower the coefficient the better the wall from the insulation standpoint.

When a fill insulation is installed between 2 x 4 studding, the thickness of insulation obtained is 3⅝" as this is the actual width of 4" lumber. Now it is true of course, that 3⅝" of insulation is about three and one-half times as much insulations as 1", but when installed in a wall, the effect is entirely different because heat and cold insulation materials are governed by what is known as the law of diminishing return. This means that the first half inch, for example, is the most effective and each ½" thereafter is less and less effective from the standpoint of retarding or "stopping" heat transfer. Finally, a point is reached at which the additional value of the next layer of insulation is too small to warrant its use.

An Example

Figure 1 will illustrate this point. The standard brick veneer frame wall previously referred to has a coefficient of transmission of 0.28. If ½" of rigid insulation having a conductivity of 0.33 Btu per hour per square foot per degree Fahrenheit, is *added* to this wall the overall coefficient will be about 0.196, and the rate of heat loss through the wall will be reduced about 30 per cent, as the result of this ½" of insulation.

Now if a second ½" layer of rigid insulation is applied to the wall, the coefficient of transmission will be further reduced to 0.151 or about 16 per cent more than the first layer. The third layer will reduce the coefficient to 0.123, or about 10 per cent additional, whereas the fourth layer will "stop" about 6.9 per cent more of the heat which would pass through the wall in any given period of time. In other words, the first, second, third, and fourth layers will reduce the heat loss respectively, 30, 16, 10 and 6.9 per cent, in this particular case. These coefficients and percentages are shown in Table 1.

Figure 1 shows graphically the successive insulation values of eight layers of insulation, a total thickness of 4". In this case, the first inch of insulation "stops" 46 per cent of the heat passing through the insulated areas and the first 1½", 56 per cent. The remaining 2½" of the total thickness of 4" "stops" only 21.2 per cent more than the first 1½". Note that the last layer "stops" only 2.4 per cent of the heat. It is apparent, therefore, that the first 1" or 1½" of insulation is by far the most effective. Although the percentages would be slightly different with other types of frame walls, such as those with shingle, siding or stucco exterior, the results would be comparable, and the general principle of diminishing return on each succeeding layer would hold true.

Economic Considerations

Fill type materials are used solely as insulation, having no structural qualities which permit their use for other purposes. As previously stated, rigid insulations may also be used solely as an insulation in conjunction with ordinary structural building materials, or they may replace certain materials such as wood sheathing, wood lath or metal lath or they may be used as an interior finish in place of materials otherwise necessary. When used as sheathing or as a plaster base they serve not

TABLE 1

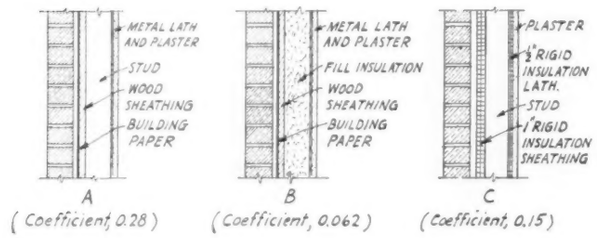
Percentages of Heat "Stopped' by Successive Half-Inch Layers of Insulation Applied to a Standard Frame Brick Veneer Wall

Layer of Insulation	Thickness of Insulation Inches	Coefficient	Per cent Reduction	Per cent Heat "Stopped" per ½" Layer
	0	0.28	0	0
1	½	0.196	30	30
2	1	0.1513	46	16
3	1½	0.1232	56	10
4	2	0.1038	62.9	6.9
5	2½	0.0896	67.9	5.0
6	3	0.079	71.8	3.9
7	3½	0.0705	74.8	3.0
8	4	0.0637	77.2	2.4

only as insulation, but also as a structural material, and while some of the materials replaced may provide a certain amount of heat resistance, the rigid insulation itself usually has much more heat resistance than the materials replaced. On the other hand, when a fill insulation is installed between studding so as to completely fill the air spaces, the value of such air spaces is lost.

Insulation Costs

In some cases the rigid insulation may cost no more than the materials replaced and the net heat resistance or insulating value derived from the rigid insulation in such cases is greater. For example, in the Chicago area ½" rigid insulation as a plaster base and plaster cost about the same as metal lath and plaster. The metal lath, of course, has no insulating value, and consequently the insulating value of the rigid insulation is obtained without additional cost. If 1" rigid insulation as a plaster base is used in place of metal lath, the additional cost of this thickness of rigid insulation usually will be



Uninsulated brick veneer construction heat loss compared to the heat loss of fill and rigid insulation. In addition to insulating, rigid insulation replaces some other materials.

only 2½c to 3c per square foot. Furthermore, rigid insulation has certain advantages as a plaster base. The same reasoning applies to the use of rigid insulation for sheathing. The ½" thickness usually costs no more than lumber sheathing and building paper, whereas the 1" thickness ordinarly costs only 2½c per square foot more than lumber sheathing and building paper, as installed. Rigid insulation as sheathing also has advantages over lumber, such as greater bracing strength and elimination of the multitude of cracks between boards, which will be discussed later. Consider a brick veneer frame wall; with wood sheathing, building paper, metal lath and plaster, this wall has an overall coefficient of transmission of 0.28. (See "A," Figure 2.) A similar wall with 3⅝" of fill insulation[b] has a value of 0.062, assuming that the fill does not settle or become wet, and the full value is thereby obtained. ("B," Figure 2.) With 1" rigid insulation in place of the wood sheathing and building paper, and ½" in place of the metal lath, the coefficient of transmission of the wall (without the fill insulation) is 0.15, according to the A.S.H.V.E. Guide, 1936. ("C," Figure 2.) The difference between the rigid insulation wall and the uninsulated wall is 0.28 minus 0.15 or 0.13 Btu per hour per square foot per degree F. difference in temperature, and the additional cost of the rigid insulation will average 2½ cents per square foot. The difference between the fill insulated wall and the uninsulated wall is 0.28 minus 0.062, or 0.218, and the average additional cost of wall-thick fill insulation batts is 10 cents per square foot. The blow-in type of fill installation usually costs 12 cents per square foot, or more. In other words, the first 0.13 Btu saving due to the rigid insulation costs 2½ cents per square foot, whereas the *additional* saving of 0.088 Btu obtained by the use of fill insulation instead of rigid insulation costs from 7½ cents to 9½ cents or more, per square foot, additional.

On the basis of 1,000 square feet of wall area, the cost of the rigid insulation is $25.00 and the saving is 130 Btu per hour, per degree difference in temperature. The additional cost of the fill insulation over the rigid insulation is $75.00 to $95.00 or more per 1,000 square feet, but the additional saving is only 88 Btu per hour per degree difference in temperature. This simple example further illustrates the principle of diminishing return.

Comparisons between various types of insulations are sometimes made on the basis of the return on the investment, that is, the value received for the money expended. In the problem under consideration, if the building is located in Chicago, and oil is the fuel used, the theoretical saving with rigid insulation will amount to about 224.5 gallons per 1,000 square feet of wall area insulated per heating season.[c] If oil costing 6 cents per gallon is used as fuel, the dollar value of this saving will amount to $13.47 per heating season, and the return on the investment is obtained by dividing this saving by the cost of the insulation and multiplying by 100 to change to per cent, or

$$\frac{13.47}{25.00} \times 100 = 53.9\%$$

The theoretical saving obtained by installing 3⅝" of fill insulation between the studding of the uninsulated wall will amount to 376 gallons per heating season, per 1000 square feet of wall area.[d] The return on the investment on the basis of fill insulation batts costing 10 cents per square foot or $100.00 per 1000 square feet, will amount to 22.6 per cent annually, or 18.8 per cent on the basis of fill insulation costing 12 cents per square foot.

The returns on the investment would be in the same range for coal. For manufactured gas heat, where the cost per unit of heat is high, the returns on the investment would be considerably higher.

Practical Considerations

All of the comparisons made in this article have been based on the assumption that the full value of the insulation is obtained. In practice, however, the value of fill insulation may be diminished because of four major factors, namely: (1) settling and bridging in walls, (2) attenuation of insulation in walls and ceilings, (3) mois-

[b]This coefficient of transmission is based on a conductivity of 0.27 per inch for the fill insulation. Many fill materials on the market have a higher or less favorable conductivity.

[c]This is based on oil having a heating value of 141,000 Btu per gallon, and a heating efficiency of 70 per cent. The average outside temperature during the heating season is assumed to be 36 degrees, and the inside temperature maintained is assumed to be 70 degrees.

[d]This is based on oil having a heating value of 141,000 Btu per gallon, and a heating efficiency of 70 per cent. The average outside temperature during the heating season is assumed to be 36 degrees, and the inside temperature maintained is assumed to be 70 degrees.

(*Continued on page* 56)

Pressure Losses In Rectangular Elbows* [Part 3]

By R. D. Madison[1] and J. R. Parker[2]

The authors present data on pressure losses in rectangular elbows as affected by (a) the radius ratios of the elbows, (b) the aspect ratios of the elbows, (c) angle of the bend, (d) the elbow size, (e) velocity of flow, (f) splitters in the elbows, and (g) compound elbows. In general, data are given (1) for the elbow situated in a duct system with ducts preceding and following the elbow, and (2) the elbow at the end of a duct and discharging freely into air.

Effect of Splitters on Pressure Loss

THE use of splitters in elbows to reduce the total pressure loss is becoming more and more common, but there is very little engineering information upon the subject at the present time. Having shown (from curve *A*, Fig. 9) that there is very little change in the loss for the usual aspect ratios above unity, the principal benefit to be derived from the use of splitters is through an increase of the radius ratio. It would seem to be desirable to place the splitters in such a position as to obtain equal radius ratios for the smaller elbows formed by the splitters. This will not only simplify the calculation of loss but will also make for greater economy of material.

The necessary calculations for locating splitters to obtain equal radius ratios can be made with the aid of a chart such as is shown in Fig. 13, which is reproduced from "Fan Engineering."[7] The chart is laid out for calculating the position when one, two, or three splitters are used. No. 1 of 3, No. 2 of 3, etc., refer to the respective splitters starting from inside. To use the chart in Fig. 13, divide the pipe width (difference of radii) by the inside radius. Locate this value as an abscissa on the chart, move upward to the desired splitter line (depending on the number used) and then to the left of the chart where the ratios of the splitter radii to the inside radius may be found. These values, each multiplied by the inside radius of the original elbow will give the radii upon which to construct the splitters. Incidentally, it will be observed that the reciprocal of the first or lowest value is the curve ratio of the revised elbow.

The use of curve ratio offers another method of procedure and simplifies the splitter loss calculation. This may be shown by the following:

Let r_a = inside radius of an elbow, r_1 = radius of first (inside) splitter, r_2 = radius of second splitter, r_x = radius of xth (last) splitter, r_b = outside radius

[7] "Fan Engineering," by W. H. Carrier and R. D. Madison, Buffalo Forge Co., Buffalo, N. Y.

[1]Research Engineer, Buffalo Forge Company. Mem. A.S.M.E.
[2]Engineer, Buffalo Pumps, Inc.
*Contributed by the Aeronautic Division and presented at the Annual Meeting of The American Society of Mechanical Engineers held in New York, N. Y., December 2 to 6, 1935.

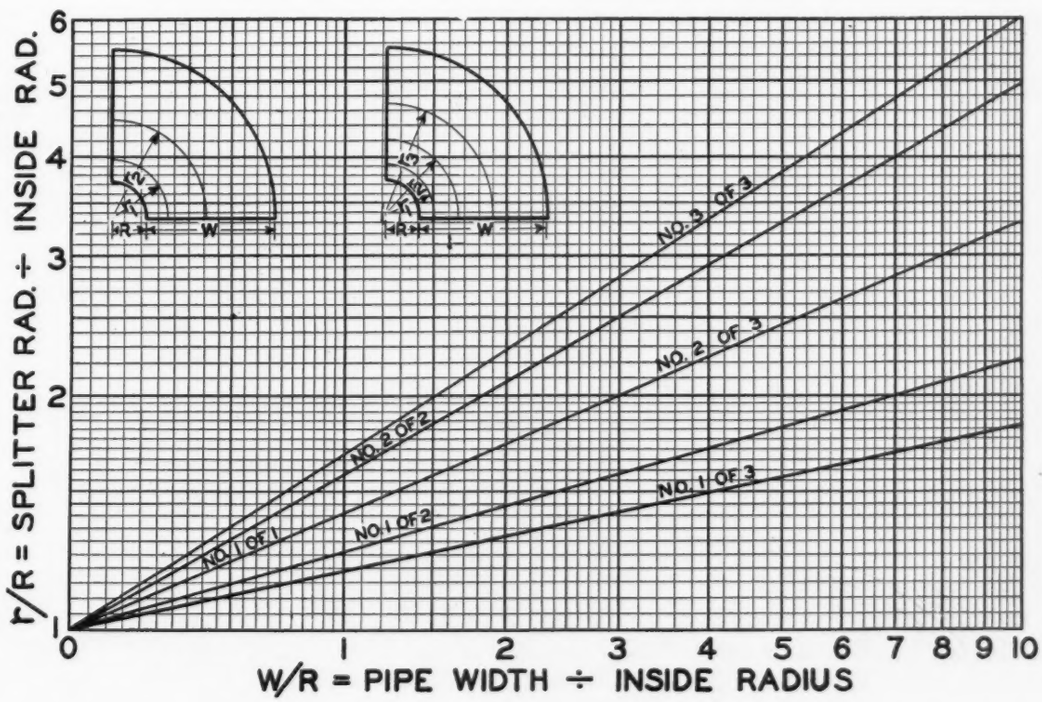


Fig. 13. Chart for Determining the Location of Elbow Splitters.

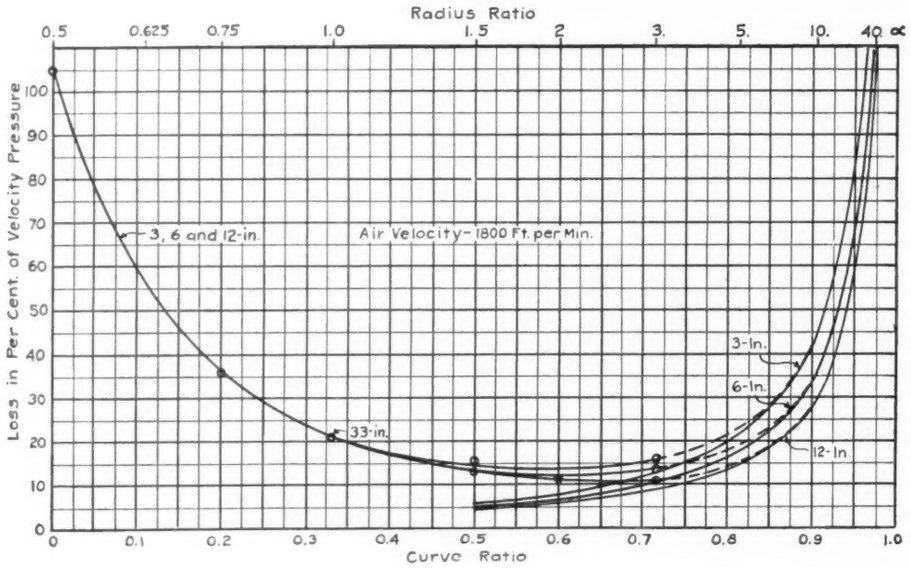


Fig. 11. Effect of the Size of 90-Deg. Elbows on the Pressure Loss.

of elbow, and x = number of splitters. Now CR = curve ratio of plain elbow $= r_a/r_b$. Let CR' = curve ratio of each component elbow formed by splitters. Then

$$CR' = r_a/r_1 = r_1/r_2 = r_2/r_3 \ldots\ldots r_x/r_b$$

but

$$(CR')^{x+1} = r_a/r_1 \times r_1/r_2 \times r_2/r_3 \ldots \times r_x/r_b = r_a/r_b = CR$$

$$CR' = \sqrt[x+1]{CR}$$

Therefore, it may be seen that the new curve ratio effected by the addition of a single splitter $= \sqrt{CR}$; the curve ratio due to two splitters $= \sqrt[3]{CR}$; etc. Dividing the inside radius of an elbow with splitters by the curve ratio of the elbow gives the actual radius of the first or inside splitter. Dividing the radius of the first splitter by the curve ratio gives the radius of the second splitter, etc. The curve ratio determined in this manner can be used in conjunction with Fig. 11 for determining the expected pressure loss in elbows fitted with splitters. Note that for each of the individual elbows formed by the splitters the curve ratio found by this method is the same as that found by the method employing Fig. 13.

The following example is given to illustrate the method of computing the pressure loss in a 28-in. × 38-in. elbow, with a radius ratio of 1 (curve ratio of 0.33) an aspect ratio of 1.36 and having one splitter. The elbow is considered to be preceded and followed by ducts. Since the inside radius of this elbow is 14 in. locate the point $28/14 = 2$ as an abscissa of Fig. 13. Follow this abscissa to the line marked "No. 1 of 1" and read at the left the value of $r/R = 1.72$. Since R/r is the curve ratio for the revised elbow the reciprocal of 1.72, which is 0.58, will be the new curve ratio. The corresponding pressure loss for a curve ratio of 0.58 in a 12-in. elbow (the largest shown in Fig. 11) is 11.5 per cent of the velocity head. This is the same loss that was actually obtained by test on this size elbow. The actual loss on the original elbow (without splitter) was 22.3 per cent of the velocity head compared with a value of 21.5 as read from the curve in Fig. 11.

The pressure loss can be found directly from the curve ratio and Fig. 11. As an illustration of this procedure take a 12⅜-in. × 12⅜-in. elbow with a 5-in. throat radius and one splitter. The curve ratio of the original elbow is $5/(17\frac{3}{8}) = 0.288$ and from Fig. 11 the original loss should be 0.25 velocity head. An actual

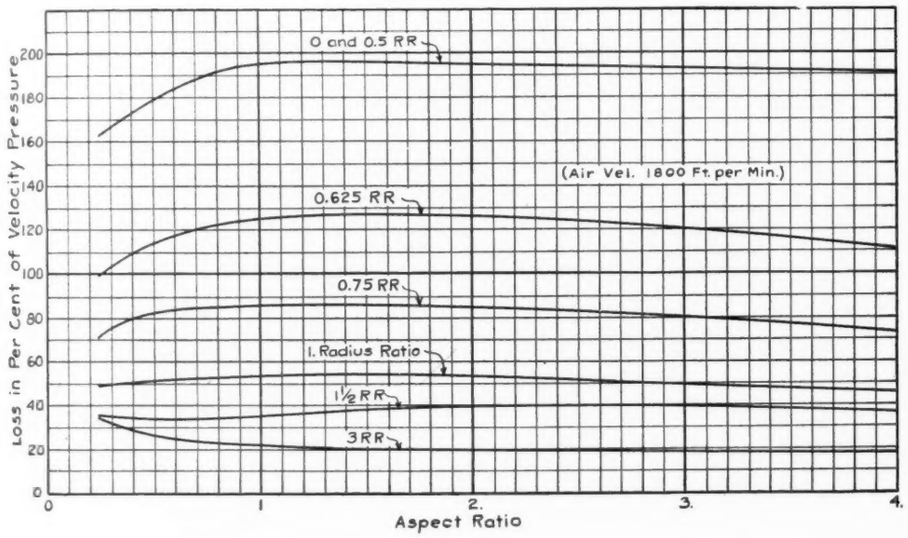


Fig. 14. Pressure Losses in 90-Deg. Elbows Discharging Directly into the Air.

test on such an elbow gave a pressure loss of 0.26 velocity head. Using the previously given equation for determining the curve ratio of an elbow with one splitter, the curve ratio is $\sqrt{0.288} = 0.536$. The loss corresponding to this value as read from Fig. 11 is 0.12 velocity head. An actual test on such an elbow gave a pressure loss of 0.10 velocity head.

These illustrations indicate that a single splitter in an elbow will materially reduce the pressure loss if the value of the curve ratio is sufficiently small. With a curve ratio greater than 0.5 ($1\frac{1}{2}$ *RR*) there is little or nothing at all to be gained by the use of splitters. As an example of this, a 6-in. × 6-in. elbow with 0.5 curve ratio was tested, first, with a single splitter and then, with three splitters. From the curve Fig. 11 there would be an expected loss of about 13.5 per cent of the velocity head for the elbow without splitters and about the same value, 13.5 per cent of the velocity head, with one splitter. The actual test with one splitter showed a loss of 12.4 per cent of the velocity head. In the case of three splitters the new curve ratio $= \sqrt[4]{0.50} = 0.84$ which indicates a loss of 22 per cent for a 6-in. elbow. The actual test showed a 17 per cent loss indicating an upward sweep in the loss curve at this point. Where several splitters are used the increase in aspect ratio becomes a more important factor. In the previously given case this would reduce the loss to about 70 or 80 per cent of the loss in a corresponding elbow with an aspect ratio of unity. In view of this fact the test value of 17 per cent is more rational ($0.75 \times 22 = 16.5$). Where one or more splitters are placed in an elbow having an aspect ratio much less than unity, the curves of Figs. 8 or 9 should be applied. Thus, the component elbows formed by the addition of splitters will have lowered aspect ratios and the corresponding loss factors may be appreciably less than that of the original elbow. As the benefit of lowered aspect-ratio factors will not be the same for the component elbows the average value may be used. This benefit is in addition to that due to increased curve ratio. Actually there is still another factor. This factor is the size of the elbow, and it will modify test results but in general it will be simpler to omit this factor, except for very large size variations.

Effect of Elbows at the End of Ducts

Although elbows are used in duct systems generally for changing the direction of flow, they are frequently used as outlet openings with no ducts attached. Since the pressure loss in elbows used for this latter purpose is materially higher than when the elbows are used in a duct system, information should be available on the pressure losses when the elbows discharge directly into the atmosphere. Tests were run on such elbows with a 36-sq. in. in cross-sectional area and the results plotted in Fig. 14. Atttention should be called to the fact that these elbows had 1-in. extensions on each end for connecting them to ducts and so there is a slight modification from a true 90-deg. turn. This modification varies with the radius ratio and probably with the aspect ratio. When a 6-in. × 6-in. elbow with 0.5 *RR* had the 1-in. extension on the discharge side removed, the pressure loss fell from 195 per cent to 172 per cent. This was due to reducing the effective angle of turn in the air flow although a complete 90-deg. metal elbow remained. On the same size elbow but with a radius ratio of $1\frac{1}{2}$ no appreciable difference in loss resulted when the elbow was reduced to a standard 90-deg. turn.

Comparing the results of Figs. 14 and 7 it will be observed that for common elbows having radius ratios between 1 and 2 and aspect ratios between $\frac{1}{2}$ and 2,

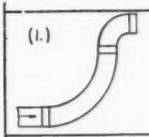
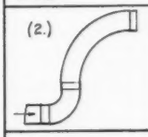
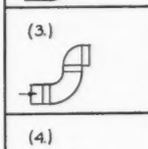
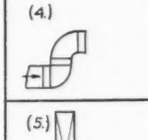
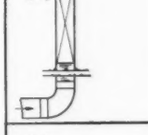
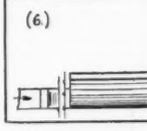
Case No	First Elbow		Second Elbow		Elbows Only			Elbows followed by Duct		
	RR	AR	RR	AR	Act.	Est. Sum	% of Est.	Act.	Est Sum.	% of Est.
(1.) 	3.	4	1.5	4.	37.2	48.5	77	27.6	21.5	128.
(2.) 	1.5	4	3	4.	24.2	30	81.	26.4	21.5	123
(3.) 	1.5	4	0.5	4	245.	202.	121.	115	85	135.
(4.) 	0.5	4.	1.5	4.	162	112.	69.	103	85	121.
(5.) 	1.5	4.	1.5	0.25	45.5	48.	95	34.6	38.	91
(6.) 	1.5	0.25	1.5	4.	55.	65.	85.	38.5	38.	101.

Fig. 15. Results of Tests on 3-In. × 12-In. Compound Elbows.

the elbow discharging directly into the air has a loss from $2\frac{1}{2}$ to 3 times the same elbow when followed by a duct. The effect of using splitters is to lessen the regain value of the following duct and to lessen the difference in loss when the elbow is tested in the two different manners.

Effect of Compound Elbows on Pressure Loss

The use of two elbows adjacent to one another often becomes necessary in duct work, and, while the losses may be figured separately for each of the component parts of the compound elbow, the combined loss as determined from tests may be considerably different from those obtained by calculation. Several of the simpler combinations were tested by the authors with the results as shown in Figs. 15 and 16.

In these figures the column labeled "estimated sum" is the sum of the test losses in the separate elbows, assuming that in each case the first elbow in the line of flow is always followed by a duct. In case the second elbow discharges directly into the air, the assumed value for the loss in the second elbow is from tests in which no discharge duct was used. In case the second

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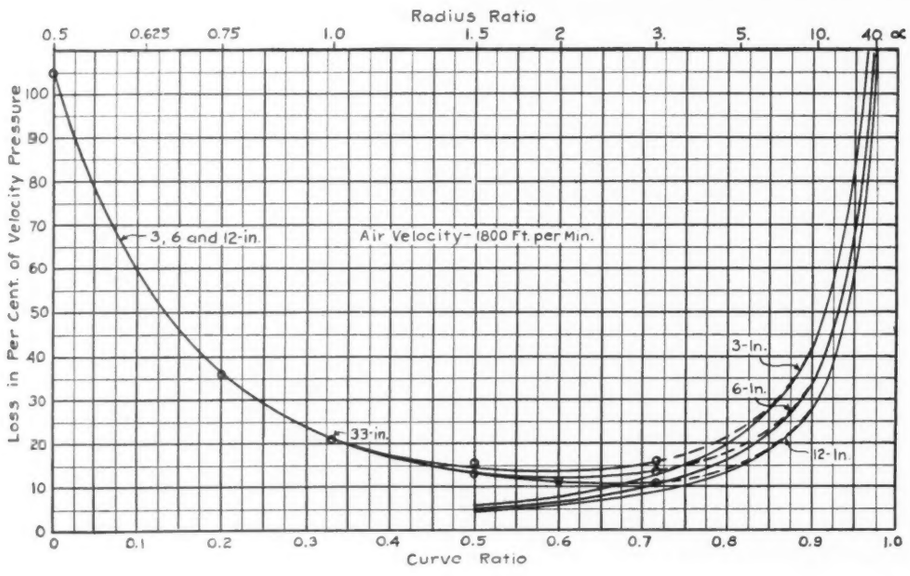

Fig. 11. Effect of the Size of 90-Deg. Elbows on the Pressure Loss.

of elbow, and x = number of splitters. Now CR = curve ratio of plain elbow $= r_a/r_b$. Let CR' = curve ratio of each component elbow formed by splitters. Then

$$CR' = r_a/r_1 = r_1/r_2 = r_2/r_3 \ldots\ldots r_x/r_b$$

but

$$(CR')^{x+1} = r_a/r_1 \times r_1/r_2 \times r_2/r_3 \ldots\ldots \times r_x/r_b = r_a/r_b = CR$$

$$CR' = \sqrt[x+1]{CR}$$

Therefore, it may be seen that the new curve ratio effected by the addition of a single splitter $= \sqrt{CR}$; the curve ratio due to two splitters $= \sqrt[3]{CR}$; etc. Dividing the inside radius of an elbow with splitters by the curve ratio of the elbow gives the actual radius of the first or inside splitter. Dividing the radius of the first splitter by the curve ratio gives the radius of the second splitter, etc. The curve ratio determined in this manner can be used in conjunction with Fig. 11 for determining the expected pressure loss in elbows fitted with splitters. Note that for each of the individual elbows formed by the splitters the curve ratio found by this method is the same as that found by the method employing Fig. 13.

The following example is given to illustrate the method of computing the pressure loss in a 28-in. × 38-in. elbow, with a radius ratio of 1 (curve ratio of 0.33) an aspect ratio of 1.36 and having one splitter. The elbow is considered to be preceded and followed by ducts. Since the inside radius of this elbow is 14 in. locate the point $28/14 = 2$ as an abscissa of Fig. 13. Follow this abscissa to the line marked "No. 1 of 1" and read at the left the value of $r/R = 1.72$. Since R/r is the curve ratio for the revised elbow the reciprocal of 1.72, which is 0.58, will be the new curve ratio. The corresponding pressure loss for a curve ratio of 0.58 in a 12-in. elbow (the largest shown in Fig. 11) is 11.5 per cent of the velocity head. This is the same loss that was actually obtained by test on this size elbow. The actual loss on the original elbow (without splitter) was 22.3 per cent of the velocity head compared with a value of 21.5 as read from the curve in Fig. 11.

The pressure loss can be found directly from the curve ratio and Fig. 11. As an illustration of this procedure take a 12⅜-in. × 12⅜-in. elbow with a 5-in. throat radius and one splitter. The curve ratio of the original elbow is $5/(17\frac{3}{8}) = 0.288$ and from Fig. 11 the original loss should be 0.25 velocity head. An actual

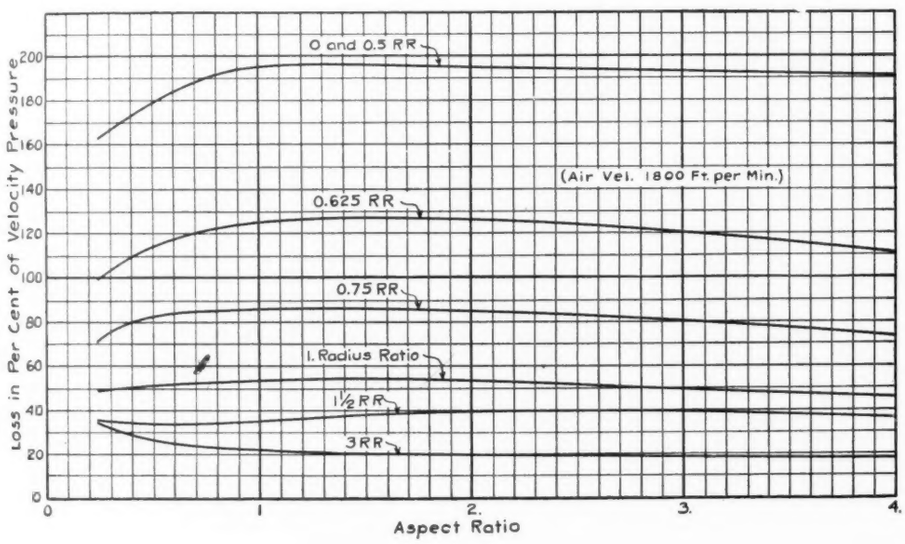

Fig. 14. Pressure Losses in 90-Deg. Elbows Discharging Directly into the Air.

test on such an elbow gave a pressure loss of 0.26 velocity head. Using the previously given equation for determining the curve ratio of an elbow with one splitter, the curve ratio is $\sqrt{0.288} = 0.536$. The loss corresponding to this value as read from Fig. 11 is 0.12 velocity head. An actual test on such an elbow gave a pressure loss of 0.10 velocity head.

These illustrations indicate that a single splitter in an elbow will materially reduce the pressure loss if the value of the curve ratio is sufficiently small. With a curve ratio greater than 0.5 ($1\frac{1}{2}$ *RR*) there is little or nothing at all to be gained by the use of splitters. As an example of this, a 6-in. × 6-in. elbow with 0.5 curve ratio was tested, first, with a single splitter and then, with three splitters. From the curve Fig. 11 there would be an expected loss of about 13.5 per cent of the velocity head for the elbow without splitters and about the same value, 13.5 per cent of the velocity head, with one splitter. The actual test with one splitter showed a loss of 12.4 per cent of the velocity head. In the case of three splitters the new curve ratio $= \sqrt[4]{0.50} = 0.84$ which indicates a loss of 22 per cent for a 6-in. elbow. The actual test showed a 17 per cent loss indicating an upward sweep in the loss curve at this point. Where several splitters are used the increase in aspect ratio becomes a more important factor. In the previously given case this would reduce the loss to about 70 or 80 per cent of the loss in a corresponding elbow with an aspect ratio of unity. In view of this fact the test value of 17 per cent is more rational ($0.75 \times 22 = 16.5$). Where one or more splitters are placed in an elbow having an aspect ratio much less than unity, the curves of Figs. 8 or 9 should be applied. Thus, the component elbows formed by the addition of splitters will have lowered aspect ratios and the corresponding loss factors may be appreciably less than that of the original elbow. As the benefit of lowered aspect-ratio factors will not be the same for the component elbows the average value may be used. This benefit is in addition to that due to increased curve ratio. Actually there is still another factor. This factor is the size of the elbow, and it will modify test results but in general it will be simpler to omit this factor, except for very large size variations.

Effect of Elbows at the End of Ducts

Although elbows are used in duct systems generally for changing the direction of flow, they are frequently used as outlet openings with no ducts attached. Since the pressure loss in elbows used for this latter purpose is materially higher than when the elbows are used in a duct system, information should be available on the pressure losses when the elbows discharge directly into the atmosphere. Tests were run on such elbows with a 36-sq. in. in cross-sectional area and the results plotted in Fig. 14. Atttention should be called to the fact that these elbows had 1-in. extensions on each end for connecting them to ducts and so there is a slight modification from a true 90-deg. turn. This modification varies with the radius ratio and probably with the aspect ratio. When a 6-in. × 6-in. elbow with 0.5 *RR* had the 1-in. extension on the discharge side removed, the pressure loss fell from 195 per cent to 172 per cent. This was due to reducing the effective angle of turn in the air flow although a complete 90-deg. metal elbow remained. On the same size elbow but with a radius ratio of $1\frac{1}{2}$ no appreciable difference in loss resulted when the elbow was reduced to a standard 90-deg. turn.

Comparing the results of Figs. 14 and 7 it will be observed that for common elbows having radius ratios between 1 and 2 and aspect ratios between $\frac{1}{2}$ and 2,

Case No	First Elbow		Second Elbow		Elbows Only			Elbows followed by Duct		
	RR	AR	RR	AR	Act.	Est. Sum	% of Est.	Act.	Est Sum.	% of Est.
(1.)	3.	4	1.5	4.	37.2	48.5	77	27.6	21.5	128.
(2.)	1.5	4	3	4.	24.2	30	81.	26.4	21.5	123
(3.)	1.5	4	0.5	4	245.	202.	121.	115	85.	135.
(4.)	0.5	4.	1.5	4.	162	112.	69.	103	85	121.
(5.)	1.5	4.	1.5	0.25	45.5	48.	95	34.6	38.	91
(6.)	1.5	0.25	1.5	4.	55.	65.	85.	38.5	38.	101.

Fig. 15. Results of Tests on 3-In. × 12-In. Compound Elbows.

the elbow discharging directly into the air has a loss from $2\frac{1}{2}$ to 3 times the same elbow when followed by a duct. The effect of using splitters is to lessen the regain value of the following duct and to lessen the difference in loss when the elbow is tested in the two different manners.

Effect of Compound Elbows on Pressure Loss

The use of two elbows adjacent to one another often becomes necessary in duct work, and, while the losses may be figured separately for each of the component parts of the compound elbow, the combined loss as determined from tests may be considerably different from those obtained by calculation. Several of the simpler combinations were tested by the authors with the results as shown in Figs. 15 and 16.

In these figures the column labeled "estimated sum" is the sum of the test losses in the separate elbows, assuming that in each case the first elbow in the line of flow is always followed by a duct. In case the second elbow discharges directly into the air, the assumed value for the loss in the second elbow is from tests in which no discharge duct was used. In case the second

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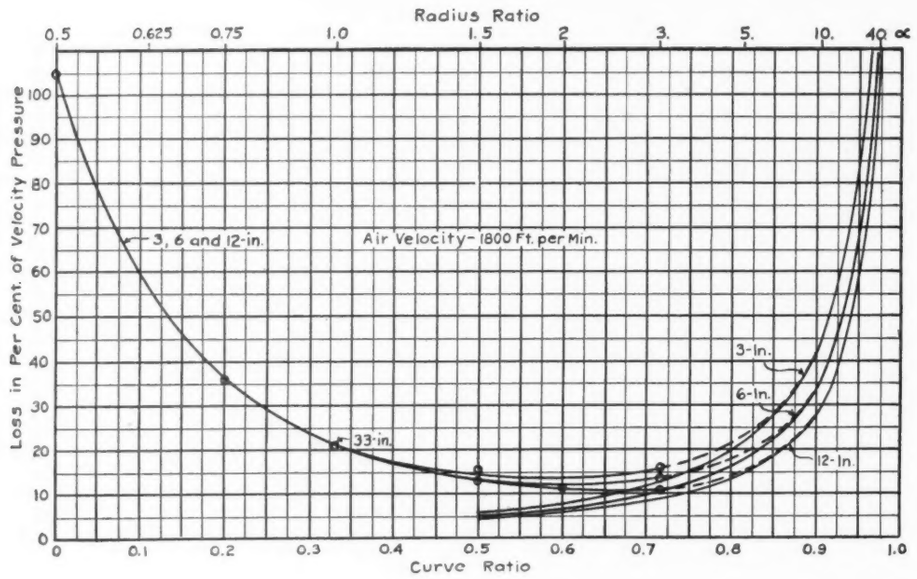

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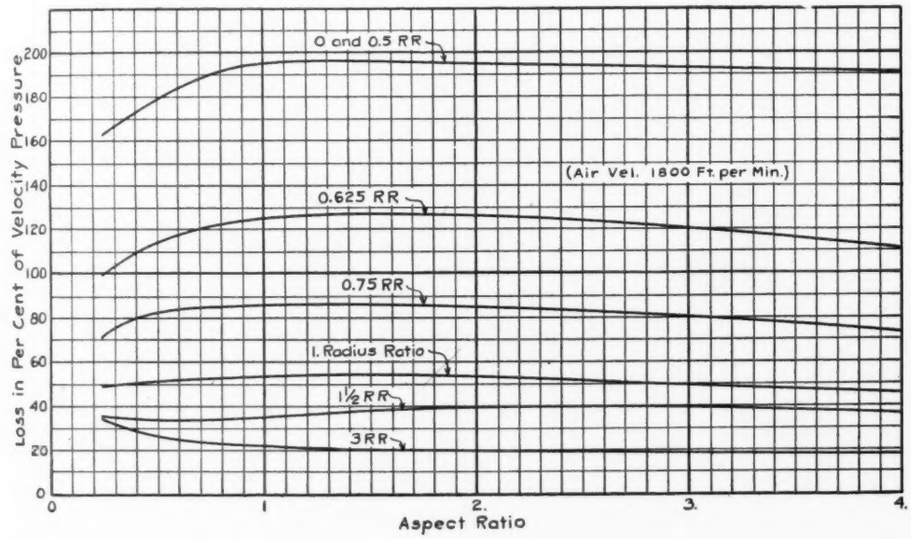

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Fig. 15. Results of Tests on 3-In. × 12-In. Compound Elbows.

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In these figures the column labeled "estimated sum" is the sum of the test losses in the separate elbows, assuming that in each case the first elbow in the line of flow is always followed by a duct. In case the second elbow discharges directly into the air, the assumed value for the loss in the second elbow is from tests in which no discharge duct was used. In case the second

(*Continued on page* 60)

Rigid Insulation

(*Continued from page* 52)

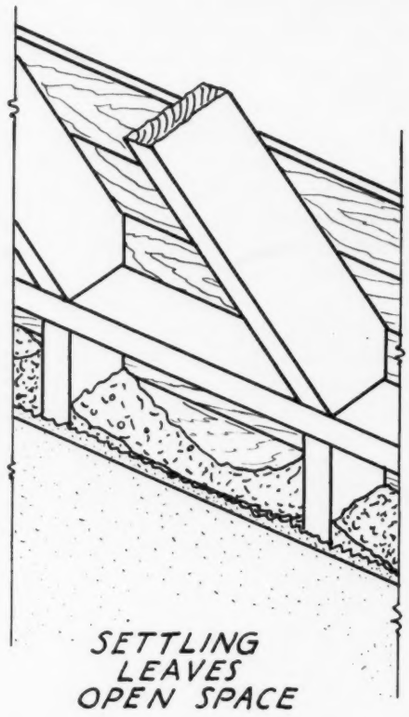
ture condensation within the insulation and, (4) loss due to studding, headers and other framing members.

Fill types of insulation installed between studding in vertical walls naturally have a tendency to settle and compress. The objections to this settling are two-fold, first, that it increases the density of the insulation, thereby decreasing its insulating value, and, second, the settling leaves an air space above the fill which has an insulating value equivalent to only one-third of an inch of insulation.

The tendency to settle depends upon type of fill, that is whether in batt form or loose and the degree to which the fill is packed or tamped, that is upon the initial density. Obviously, the lighter or the more fluffy the initial condition of the fill within the wall, the greater will be the degree to which it will settle or compress. This is especially true of loose fills. The batt form is preferred by many insulating men.

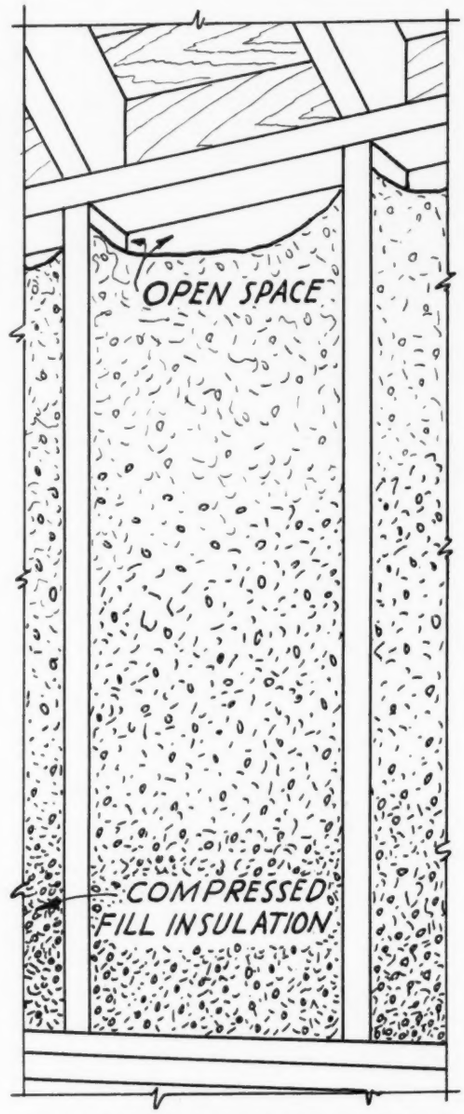
Fill types of insulations are subject to compression due to their own weight, depending upon the extent to which they are packed or wedged between the studding. If a column of insulation is entirely free standing, the weight of the compressive load at any level is always equal to the weight of the material above it and of course the weight diminishes toward the top.

A simple test was conducted to determine the extent of the compression of a column of fill insulation due to its own weight. Batts having a normal density of 4 pounds per cubic foot were stacked to an equivalent height of 9 feet. The weight at the bottom of the column was therefore 36 lb./sq. ft. and zero at the top.



The lower ten batts compressed an average of 44.8 per cent, whereas the lower twenty-one batts compressed 35½ per cent. The average compression of the entire column of batts due to its own weight was about 32 per cent.

It should be recognized that fill type batts are usually installed between the framing members in such a manner that each bat derives support from the wedging



If between-stud fill insulation settles, a space for heat escape results at the top of the space. The fill at the bottom is compressed and losses its porosity.

effect. Loose fills, however, have less structure than batts and are much more likely to compress due to their own weight. As soon as any part of the column of insulation becomes loose, this additional weight is thrust upon the column of insulation below, thereby increasing the tendency for the lower courses of insulation to settle or pack. Also, there may be progressive amounts of compression and settling accentuated by such factors as trucks, street cars, railways, wind vibration and other factors which tend to cause vibration of the building, particularly a frame building which has less resistance to vibration.

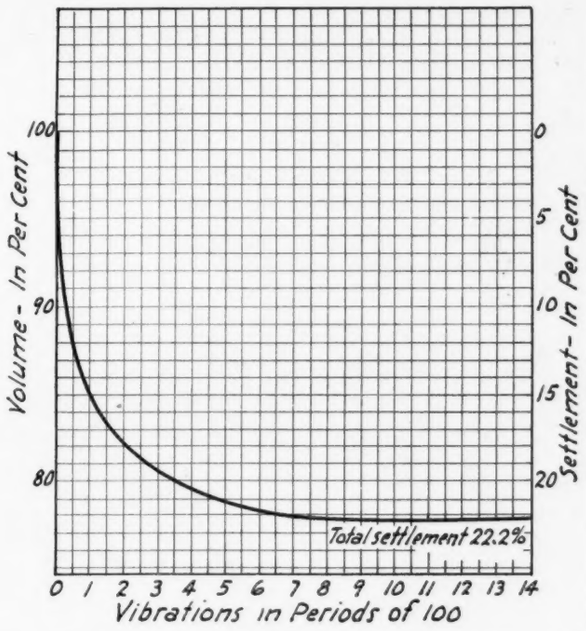


Fig. 3. Chart showing settlement in terms of per cent of volume for fill insulation.

Laboratory tests further show the extent to which settling takes place in the vertical walls of a building as the result of excessive vibration of the structure. Figure 3 shows the results of tests of nodulated mineral wool, which was packed and tamped to a density of 6.9 pounds per cubic foot by means of a 1 pound weight before the test was started. The samples were vibrated through a ⅛" drop at the rate of 200 drops per minute and readings were taken of the settlement at each 100 drops. Even after the material had been packed as described, there was a further settlement of 22.2 per cent. This material was similar to that frequently used in blow-in types of installations.

Hand packed, loose fill is usually installed to a density of at least 8 to 10 pounds per cubic foot. If the density is 8 pounds per cubic foot, a coverage of 14.5 square feet of wall area per 35 pound bag would be obtained; at 10 pounds, the coverage is 12.8 square feet of wall area (See Figure 4). It is reported that coverages as high as 50 square feet per 35 pound bag are being obtained in certain sections which would be equivalent to a density of about 2½ pounds per cubic

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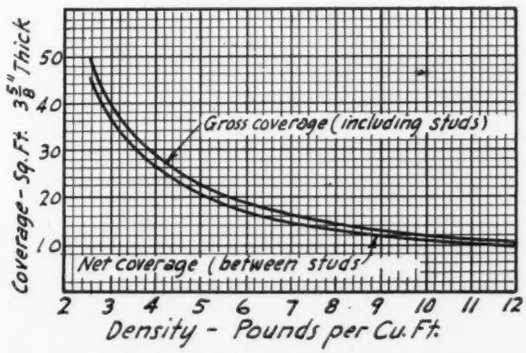

Fig. 4. As insulation is "thinned out" to get greater coverage the density decreases until insulating value is entirely lost.

Pressure Losses in Rectangular Elbows

(*Continued from page* 55)

elbow is followed by a duct the corresponding test value is used. This method is the most logical one for combining the losses in compound elbows.

The column labeled "per cent of estimate" is the ratio of the loss obtained by testing the compound elbow to the estimated loss as just outlined and serves as a means of showing the extent of the error in this method of determining the combined losses in compound elbows.

Any constraining shape of like dimensions following an elbow tends to lower the loss below that of an elbow

Case No	Plain Elbows			1 Diameter Between Elbows			Splitter in Each Elbow		
	Act.	Est. Sum	% of Est.	Act.	Est. Sum	% of Est.	Act.	Est. Sum	% of Est.
(1) 5"R, 12 3/8"	104.2	100.	104.	54.9	100.	55.	26.	30	87
(2)	93.7	100.	94	106.	100.	106.	22.	30.	73
(3)	65.5	100.	66.	75.1	100.	75.	27.4	30.	94
(4)	43.	52	83.	31.4	52	60.	15	20.	75.
(5)	62.2	52.	120.	68.3	52	131.	18.8	20.	94
(6) Length = 4 D	41.8	52.	81.	45.7	52.	88.	20.5	20.	102.

Fig. 16. Results of Tests on 12⅜-In. × 12⅜-In. Compound Elbows.

discharging freely into the air. Thus a second elbow helps to lower the loss of the first as compared with a free discharge of the first. The influence of the first elbow may help or hinder that of the second elbow depending on the conditions of flow produced at the discharge of the first. Note that in Fig. 15, the elbow loss for case 3 does not differ greatly from the loss for case 4 when the elbows are inserted in a duct, being 115 and 103 per cent, respectively; but that the losses are vastly different when the second elbow discharges directly into the air, the losses in this latter instance

for cases 3 and 4 being 245 and 162 per cent, respectively. It is interesting to note that in the case of elbows forming a side turn and having an aspect ratio near unity, as in case 3 of Fig. 16, the combined loss of 65.5 per cent is lower than that of each tested alone (73.5 per cent) when not followed by ducts. Such a condition was noted during tests on a large compound elbow (28 in. × 38 in.) with aspect ratios of 0.74 and 1.36, in which the second elbow made a side turn and discharged directly into the air. In this case, despite the arrangement, the combined loss was between 8 and 10 per cent lower than the loss due to either elbow tested separately and not followed by ducts.

The values in columns 4, 5, and 6 of Fig. 16 are given to show the influence of one diameter of duct placed between the elbows. Note that in cases 1 and 4 the duct caused a decrease in the pressure loss while in the remaining cases it increased the pressure loss, thus hindering the flow.

The benefit of splitters in elbows and especially those discharging freely into the air is evidenced from a study of columns 7, 8, and 9 of Fig. 16, wherein it is seen that the splitters materially reduce the pressure loss.

Variations in Tests

The authors wish to emphasize the fact that there are many reasons why experimental results obtained by different investigators often differ considerably. Usually the tests by the various investigators are not made upon the same bases because the conditions of the variables in the individual tests vary with different types and arrangements of equipment and apparatus. In making tests of the nature described in this paper, attention should be paid to the uniformity of flow, fits, sizes, workmanship of the ducts, and other items of this nature which will undoubtedly affect the test data. In Busey's tests no mention was made of velocity. In Wirt's tests, the elbows immediately followed a nozzle, presumably giving the air flow a plane wave front at the entrance to the elbow. In tests reported in this paper, the center velocity was higher than the average, as is customary after the air flows through a long duct.

The 12-in. elbows used by O. E. Parker were the identical elbows tested by J. R. Parker. The former used orifice co-efficients and the latter used the pitot traverse. This was no doubt a contributing factor in the variation of the reported tests (curves *B* and *C*, Fig. 5.) The importance of throat conditions on elbow loss and their influence on test results was emphasized during tests of a 3-in. elbow with a curve ratio of zero and aspect ratio of unity. The authors noted that the gage of the metal used in its construction was slightly heavier than that used for a 6-in. elbow of the same type. Although the inner radius was supposed to be zero there actually was a small radius occasioned by the thickness of metal and the use of a commercial brake. In this case the radius on the 3-in. elbow was slightly greater than that of the 6-in. elbow. Upon filling-in the corner of the 3-in. elbow with solder to obtain correct proportionality and retesting, the value of the velocity-pressure loss rose from 92 to 105 per cent.

Summary

1. Curve ratio (or likewise radius ratio) is the predominating influence on pressure loss in elbows. The loss is high and critical for low curve ratios and low and stable for high curve ratios. Little or no advantage is gained by using curve ratios greater than 0.6 (radius ratio of 2).

2. The effect of aspect ratios greater than unity is small and may be neglected for ordinary work. For low aspect ratios the loss is more pronounced and aspect ratios less than ½ warrant the use of a splitter in the elbow.

3. The amount of the loss is not exactly proportional to the angle of the bend, but becomes somewhat less in proportion as the angle increases.

4. The size of the elbow has relatively little effect upon pressure loss in elbows in common use. In elbows with large curve ratios the pressure losses approach the values for straight ducts.

5. Velocity has very little effect on elbow losses when given in per cent of velocity pressure, the losses being comparable to those due to friction in a straight duct. Where the curve ratio of the elbow is very small, approaching sharp-corner conditions, the loss will vary nearly as the square of the velocity.

6. If the air flow is not uniform in a duct just preceding an elbow, the loss will be somewhat higher than normal if the high velocity is along the inside of the elbow and will be somewhat lower than normal if the high velocity is along the outside of the elbow.

7. The flow conditions along the inside of the elbow are more critical than elsewhere, and if the elbow and duct do not align properly, a disturbance at the inner side is more detrimental than elsewhere.

8. Where elbows of small curve ratios must be used, a splitter is a very effective means of lessening the pressure loss. For elbows with curve ratios of 0.2 to 0.3 the use of a single splitter will reduce the loss to about one half the normal value.

9. Elbows discharging directly into the atmosphere may have high losses which can be effectively reduced by splitters or by attaching a short section of straight duct to the discharge end of the elbow.

10. Compound elbows may have losses considerably different from those estimated from tests of the individual elbows used to make up the compound elbow.

Acknowledgments

The authors wish to express their appreciation to the Buffalo Forge Company which sponsored most of these tests and to the engineering department of that company for valuable assistance rendered during the tests and in plotting results.

Rigid Insulation

(*Continued from page* 59)

foot. That this wool will settle and compress to an appreciable degree is inevitable, for the reasons already stated. If it compresses to 8 pounds per cubic foot it will lose over 70 per cent of its volume, with a corresponding reduction in efficiency. It is interesting to note that conductivities given in the A.S.H.V.E. Guide, 1936, are for densities ranging from a minimum of 10 pounds per cubic foot to 21 pounds.

Humidity in House Heating

(*Continued from page* 46)

3. Indoor temperature.
4. Rate of air change in the house due to ventilation, air in filtration and leakage, wind velocity etc.
5. Quantity of water evaporated in everyday household operations.
6. Number of people in the house.

Theoretic Moisture Requirements

It has already been pointed out that the air of the average small living room, 13 feet by 20 feet with a 9-foot ceiling, containing 2,340 cubic feet, at zero temperature can hold one-eighth of a pint of water. At 69 degrees its moisture capacity would be two pints, or with a relative humidity of 50 per cent its moisture content would be one pint. Seven-eighths of a pint of water would therefore have to be added to the air of this room to obtain a relative humidity of 50 per cent in heating from zero to 69 degrees with an original relative humidity at zero of 100 per cent. With only one change of air per hour[1] the quantity of water to be evaporated per day under these conditions would be $24 \times 7/8 = 21$ pints or $2\frac{5}{8}$ gallons. A small house of six times this cubic content, or 14,040 cubic feet, would require, in theory, the evaporation of nearly sixteen gallons of water per day under such conditions.

In actual practice average indoor temperatures during the winter may be appreciably lower than 69 degrees. Thus the quantity of water to be evaporated per day is not so large as that given—assuming an average outdoor temperature of zero and only one air change per hour. Moreover, a portion of the moisture required for the maintenance of healthful humidity conditions is supplied by the evaporation of water in ordinary household operations.

Moisture Requirements Cannot Be Fixed

It has been stated that the average smaller type house requires the special evaporation of from eight to twelve gallons of water per day during the heating season. The fact is that under favorable conditions on a comparatively mild day the evaporation of three or four gallons per day may give ample humidification, whereas on a severely cold day with high winds the evaporation of sixteen gallons may not be sufficient to give the same relative humidity. The daily quantity of fuel used for heating is subject to the same wide variation since the hundred pounds of coal burned on a cold, blustery day gives no higher indoor temperature than the twenty-five pounds burned on a mild day. A definite objective is set in either case. In heating, that objective is a uniform comfort temperature—maintained by burning varying quantities of fuel as demanded by changing weather conditions. In humidification, the objective is a relative humidity of from 40 to 50 per cent—the quantities of water to be evapo-

[1] The rate of air change in a well built house with double windows is placed by various investigators at from one to three changes per hour depending mostly upon wind velocity, exposure, difference between outdoor and indoor temperatures, ventilation, and use of fireplace.

(*Continued on page* 76)

Rowley on Filters

(*Continued from page* 44)

remaining the same. The effect of oil on the cotton filter is shown by comparing Test 4 with Test 3 and Test 5 with Test 2. While the velocities for these comparative tests are not exactly the same, there is evidently but little change in the air resistance due to the oil although there is a marked increase in the efficiency. By comparing Test 10 with Test 8 and Test 11 with Test 9, in which the same material was used excepting that it was sprayed with oil for Tests 10 and 11, it is found that the oil gives a small increase in pressure drop and a material increase in efficiency. In Tests 13 and 14 the addition of oil made less of an improvement in efficiency, possibly due to the fact that the initial efficiency was reasonably high but there was no change in the air resistance for the filter.

Tests Nos. 16 and 17 show the possibilities of obtaining a very efficient and low-resistant filter by the use of some such material as upholstering moss covered with oil or a viscous material. This, of course, is on the same principle as many other viscous-coated fibrous filters, although the moss used in this case was of a fairly fine fiber and not densely packed.

The density of pack determines the air resistance through the filter, controls the efficiency for a given fiber, and affects the dust holding capacity. To get the best combination of these factors many filters are built by progressively packing the fiber to increase the density as the air passes through.

It is possible to get effective cleaning of the air at reasonable cost for power and initial outlay for equipment, but to do this there are certain fundamental requirements which must be observed. First, a filter medium must be selected which is adapted to the particular problem. Second, it must be arranged in the conditioning system in such a manner that it may perform to the best advantage. Third, it must be given some attention in order to keep it in operating condition.

Selection of Filter Type

The selection of the best filter for a job is not an easy task. While there are certain types of filters which from a general inspection may be judged to have low efficiency, there will still be those which appear to have all of the requirements of a good filter and yet show a wide spread in their performance characteristics.

As to the arrangement of the filter, it is necessary first to select an advantageous point in the air stream for taking out the dust. This is usually at the entrance to the conditioning unit, but other arrangements are possible. Previous discussion has shown that low air resistance and high efficiency usually result from low air velocities passing through the filter. For this reason air velocities through the filter are much lower than those for economy in other parts of the apparatus and it is necessary to increase the area of the filter in propor-

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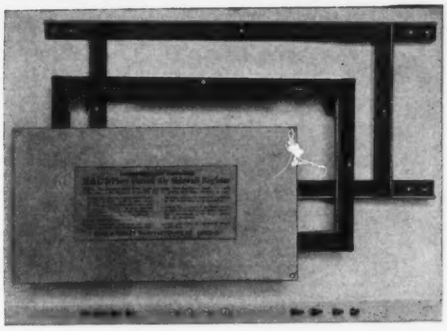

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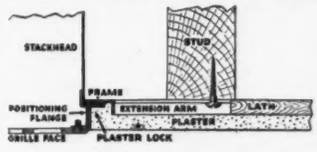

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tion to other sections of the apparatus. In the dry filter built up of a felt or other thin material this increased area is provided by building it up in accordion plaits as shown in Figs. 1 and 2. By such an arrangement the filter area can be increased to as much as 20 or more times the cross sectional area of the filter, thereby giving low velocities, low air resistance, higher efficiencies, and longer life.

For those filters which are built in the form of a pack of fibrous materials and do not lend themselves to the construction just described there are at least two ways of obtaining similar results. First, the filter packs, which for average filters are 20 inches square, may be arranged in a staggered position across the duct. By this arrangement the area or air passage through the filter may be effectively increased. Another common method is to expand the area of the pipe in the filter section, thus giving lower velocities.

The necessity for low air velocity and low air resistance depends somewhat on the type of installation. For instance filters are sometimes used in gravity warm-air furnaces. Since the total pressure head causing air circulation is then very low the filter resistance becomes an important item. In some gravity installations the filters are placed at the warm-air register outlets, and while the filter resistance may interfere with the air circulation through the particular register, it will not seriously affect the other parts of the system. In other gravity installations the filters are placed in the cold air return, and if in this position the resistance is allowed to build up there will be an unbalancing of the air flow through the riser to the different floor levels, and ultimately there may be a reversal of air flow in some of the lower floor ducts.

Maintenance

Lack of attention and upkeep is probably one of the most serious obstacles to successful air filter operation. This is particularly true for the small installations where but little attention is given to the plant. The system takes on dirt which not only lowers its efficiency but also increases the air resistance, and in time may effectively block off all air circulation. The filters are usually installed in such a way that they are not exposed for inspection without opening at least an access door to the system, and it is not an uncommon thing to find the filters of a perfectly good installation so filled with dirt and dust as not only to reduce the efficiency of the filter but to throw the whole air conditioning plant out of commission.

In conclusion, there seems to be no argument against the necessity of using air filters in many installations. The dirt and dust in the air is apparent, their effect on both property and health have been established, and the possibility of cleaning them out of the air has been demonstrated. There are many good filters available which, if properly installed and maintained, will do a first class cleaning job. It is, however, necessary to select a suitable filter and give attention to cleaning or replacing the filter.

Voorhees-Remodeling Gravity Plants

(*Continued from page* 41)

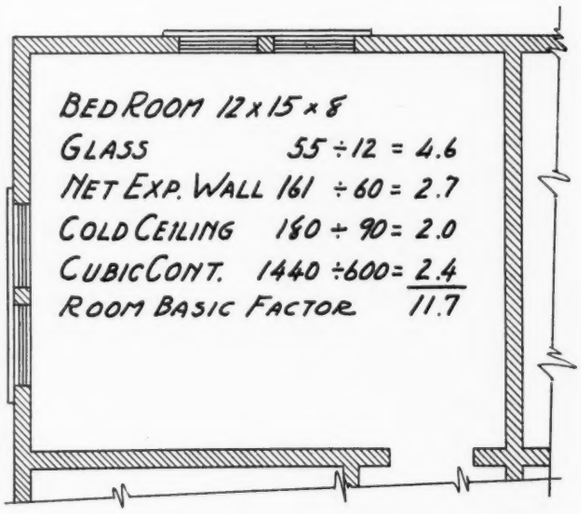

Fig. 2—The room above is used to work out a problem in temperatures and velocities with relation to air change.

Select the second floor room which has the greatest heat loss and let this tell you. Suppose for example, the corner bedroom shown in Fig. 2 has the greatest heat requirement of any second floor room and that the room basic factor, determined by either the Standard Gravity Code or the Mechanical Heating Code, is 11.7, which means that the heat loss of the room is 1000 × 11.7 = 11,700 B.t.u. per hour.

An Example Problem

Suppose also, that this room has one 3 × 12-inch riser which has a cross sectional area of 36 square inches. Then each square inch of riser area must supply 1/36th of 11,700 B.t.u., or 325 B.t.u. per hour. Referring now to Table II, we find that any of the following combinations of register temperature and air velocity in the riser will meet the heat requirements of this room:

f.p.m.	Reg. Temp.	B.t.u. per Sq. inch.
775	130	333
700	135	326
675	140	335
625	145	331
600	150	338
550	155	328
525	160	331

Selecting tentatively, the combination of 550 f.p.m. and 155 degrees, we find by referring to the accompanying Table I which is a combination and extension of Tables II and III of the Mechanical Heating Code, Third Edition, that the "C.f.m. Factor" for 155 degrees is 10.3 and the air delivery to this room will be this factor multiplied by the Room Basic Factor which is 11.7. Thus:
10.3 × 11.7 = 121 c.f.m. required to deliver 11,700 B.t.u. per hour at a register temperature of 155 deg.

Before definitely deciding on this or any other combination of register temperature and velocity, we should satisfy ourselves that the basis chosen will yield a satisfactory number of recirculations per hour, *particularly in the rooms principally occupied,* such as living room, dining room, library, etc. Since a gravity plant normally recirculates the air in the house about three times per hour (University of Illinois tests), most engineers recommend that the air circulating capacity

TABLE II

HEAT DELIVERED AT REGISTER B.T.U. PER HOUR PER SQUARE INCH OF RISER AREA.

AIR VELOCITY F.P.M.	REGISTER AIR TEMPERATURE DEGREES FAHR. 130	135	140	145	150	155	160
300	129	139	149	159	169	179	189
325	140	151	161	172	183	194	205
350	150	163	174	185	197	209	221
375	161	175	186	199	211	224	236
400	172	186	199	212	225	239	252
425	183	198	211	225	240	254	268
450	193	209	224	238	254	269	284
475	204	221	236	256	268	283	300
500	215	233	248	265	282	298	315
525	226	244	261	278	296	313	331
550	236	256	273	292	310	328	347
575	247	268	286	305	324	343	362
600	258	279	298	318	338	358	378
625	268	291	311	331	352	373	394
650	279	302	323	344	366	388	410
675	290	314	335	358	380	403	425
700	301	326	348	371	394	418	441
725	312	337	360	384	408	432	457
750	322	349	373	398	422	447	473
775	333	361	385	411	437	462	489
800	344	372	398	424	451	477	504

Fig. 3—Table 2 is used to determine the heat delivery in Btu for pre-selected combinations of register air temperature and pipe velocities.

of a mechanical system be such that the number of recirculations will be somewhere between four and eight per hour.

A small number of hourly recirculations in any given room tends to produce temperature stratification in that room; i. e., accumulation of quite warm air in the upper levels with rather cool air near the floor when the breathing line temperature is normal (approximately 70 deg.). An unusually large number of hourly recirculations on the other hand, tends to set up pronounced air currents and bring annoying drafts.

To calculate the number of recirculations or air changes per hour for a given room, multiply the number of c.f.m. supplied to the room by 60 which will give the cubic feet of air delivered per hour. Then divide this product (cu. ft. per hour) by the cubic content of the room and the quotient thus obtained will be the number of air changes per hour.

Suppose then, that the living room of the house we are now considering, is found to have a Room Basic Factor of 20.4 (heat loss = 20,400 B.t.u. per hour) and that its cubic content is 3,540 cubic feet. If we design the remodeled system on the basis of 550 f.p.m. and 155 degrees which was tentatively selected, and for which the c.f.m. factor was found to be 10.3, the air

delivery to the living room would be:

$$10.3 \times 20.4 = 210 \text{ c.f.m.}$$

The number of hourly recirculations which this provides for this room would be:

$$\frac{(210 \text{ c.f.m.}) \times (60 \text{ min. per hr.})}{(3540 \text{ cubic feet})} = 3.56 \text{ changes per hr.}$$

This is less than the desirable minimum of four changes per hour and suggests that it would be better to design the revamped system for a lower register temperature so as to get an increased air delivery. Hence, instead of adopting the combination of 550 f.p.m. and 155 degrees as the design basis, we try

TABLE III
HEATING CAPACITY OF RISER 3"x12"
THOUSANDS OF B.T.U PER HOUR

AIR VELOCITY F.P.M.	REGISTER AIR TEMPERATURE DEG. FAHR.						
	130	135	140	145	150	155	160
300	4.7	5.0	5.4	5.7	6.1	6.5	6.8
325	5.0	5.4	5.8	6.2	6.6	7.0	7.4
350	5.4	5.9	6.3	6.7	7.1	7.5	8.0
375	5.8	6.3	6.7	7.2	7.6	8.1	8.5
400	6.2	6.7	7.2	7.6	8.1	8.6	9.1
425	6.6	7.1	7.6	8.1	8.6	9.2	9.7
450	7.0	7.5	8.1	8.6	9.2	9.7	10.2
475	7.4	8.0	8.5	9.1	9.7	10.2	10.8
500	7.8	8.4	8.9	9.5	10.2	10.8	11.4
525	8.2	8.8	9.4	10.0	10.7	11.3	11.9
550	8.5	9.2	9.9	10.5	11.2	11.8	12.5
575	8.9	9.6	10.3	11.0	11.7	12.4	13.1
600	9.3	10.1	10.7	11.5	12.2	12.9	13.6
625	9.7	10.5	11.2	11.9	12.7	13.4	14.2
650	10.0	10.9	11.6	12.4	13.2	14.0	14.8
675	10.4	11.3	12.1	12.9	13.7	14.5	15.3
700	10.8	11.7	12.5	13.4	14.2	15.1	15.9
725	11.2	12.1	13.0	13.8	14.7	15.6	16.5
750	11.6	12.6	13.4	14.3	15.2	16.1	17.0
775	12.0	13.0	13.9	14.8	15.7	16.6	17.6
800	12.4	13.4	14.3	15.3	16.2	17.2	18.2

Fig. 4—Table 3 is one of a group (standard riser dimensions) and shows heat delivery capacity of a riser for pre-selected register air temperatures and pipe velocities.

another combination to meet the requirements of the second floor bedroom with a lower register temperature.

Taking a combination of 625 c.f.m. and 145 degrees, Table I shows the c.f.m. Factor for a 145-degree register temperature to be 11.6 which would give:

For the bedroom, $11.6 \times 11.7 = 136$ c.f.m.

For the living room, $11.6 \times 20.4 = 237$ c.f.m.

Since the living room is the one in which we particularly want a minimum of four air changes per hour, we investigate the number of recirculations provided in that room when its air delivery is 237 c.f.m.; thus:

$$\frac{(237 \text{ c.f.m.}) \times (60 \text{ min. per hr.})}{(3540 \text{ cubic feet})} = 4 \text{ changes per hr.}$$

Therefore, from the standpoint of better heating results in the principal rooms of the house, it appears desirable to adopt a combination of 625 f.p.m. and 145 degrees as the design basis. Table I shows that on this basis, the duct size for each room will be the Room Basic Factor, multiplied by the "Area Factor" 3.0.

Konzo - Forced Air Facts

(*Continued from page 39*)

(3) for the case of a round pipe whose length is 100 feet.

d = 0.075-lb. per cu. ft. for 70 deg. air
k = 62.4-lb. per cu. ft. of 70 deg. water
f = friction coefficient based on experiment. Values from 0.0037 to 0.0062 are used; the latter value which is frequently used introduces a fairly large factor of safety to account for the roughness existing in commercial pipes.
L = 100 ft.
$P = 3.14 \times \text{Diameter} = 3.14D$
$A = 3.14 \times \text{Radius}^2 = 3.14 \times \frac{D^2}{4}$
g = 32.16 ft. per second per second
Equation (3) becomes: (for f = 0.0062)

$$h = 0.000555 \frac{v^2}{D} \qquad (4)$$

Equation (4) can be transformed to terms of the air quantity, in cu. ft. per minute.

Let Q = cu. ft. per minute $= 60 \times v \times A$ (5)

$$= \frac{60v \times 3.14D^2}{4}$$

$$\text{then } v = \frac{4Q}{60 \times 3.14D^2} \qquad (6)$$

Substituting this value of v in equation (4):

$$h = \frac{0.000555 \times 16\ Q^2}{3600 \times 9.86 \times D^5}$$

$$\text{or } h = \text{constant} \times \frac{Q^2}{D^5} \qquad (7)$$

It may be noted from equations (4) and (7) that if the diameter of the pipe and either the velocity or the quantity of air flowing in the round pipe is known, the value of the head loss per 100 feet of duct may be calculated. Also, if the value of the head loss per 100 feet of duct and the value of the air quantity, Q, are specified, then the diameter of the round pipe may be determined.

The ordinary friction charts (Fig. 2) for round pipes are graphical representations of equations similar in type to equation (7). The differences in values that exist among the several friction charts that have been published can be accounted for by the differences in the value of the friction factor, "f," which was used in the equation for head loss (equation 3) on which the charts were based.

A correction in the value of the head loss for temperatures other than 70 deg. F. is required. The corrected value of the pressure loss, h_t may be obtained from the equation.

$$h_t = h \times \frac{70 + 460}{460 + t} = \frac{530 \times h}{460 + t} \qquad (8)$$

In most cases this correction is ignored, since the magnitude of the correction is less than the magnitude of the assumptions made in the value of the friction coefficient, "f." Furthermore, for all cases where the value of "t" is greater than 70 deg. F, the uncorrected value of "h" introduces an additional factor of safety that is not used when the temperature correction is made.

d. Resistance of Duct in Series

Resistances are additive; that is, the total resistance of a single duct is composed of the sum of the resistances for the component parts of the duct.

e. Resistance of Ducts in Parallel

The resistance of ducts which are in parallel flow arrangement are not additive. For example, if the air flow in a single trunk line is divided into two branch lines as shown in Fig. 1, the total resistance of the duct system is not equal to the sum of the resistances

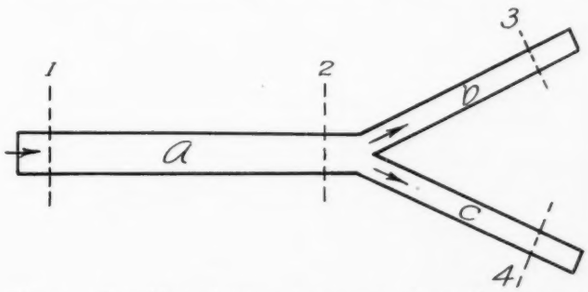

Fig. 1. Simplified diagram for use in illustrating general principles of pressure loss in ducts.

in the parts, "a", "b", and "c". It may be noted that the total pressure which exists at the junction of the two branch ducts, "b" and "c", is available for moving the air through both of the branch ducts. Furthermore, the net reduction in total pressure which accompanies the passage of air through the two branch ducts, will be exactly the same for both of the branch ducts. Therefore, for purposes of calculation it makes little difference whether the reduction in pressure of the duct system is calculated for the path "a-b" or for path "a-c."

Examples—Pressure Loss in Ducts

1. Given a round duct, 100 feet long. To convey 200 cu. ft. per minute at a velocity of 600 ft. per minute. What is the total friction pressure loss? (See Fig. 2.)

Follow up on 200 until intersection with 600 is met. Proceed horizontally to left to obtain value of 0.112 in. of water, pressure loss for 100 feet.

2. What diameter pipe is specified in case 1. Note diagonal lines in Fig. 2 for round pipe sizes.

Specified size = 7.9 in.

3. If in case 1 the duct length is 60 feet, what is pressure loss?

$$\text{Pressure loss} = \frac{60}{100} \times 0.112 = 0.0672 \text{ in. water}$$

4. Given a round duct 50 feet long to convey 200 cu. ft. per minute at a velocity of 300 ft. per minute. What is total friction pressure loss?

Follow up on 200 until intersection with 300 is obtained.

$$\text{Loss per 100 ft.} = 0.0195$$

$$\text{Loss} = \frac{50}{100} \times 0.0195 = 0.010 \text{ in.}$$

5. If pipes in case 1 and case 4 are connected in series, what is total pressure of combined pipe?

$$\text{Loss} = 0.112 + 0.010 = 0.122 \text{ in.}$$

6. If 10 pipes each of the size and capacity of that specified in Case 1 are attached singly to the bonnet of a warm-air furnace, what is the total pressure that should be provided in the bonnet to force the air through the 10 individual pipes?

Note that this pressure is not 10 times 0.112 inches. Since the pipes are in parallel flow arrangement the pressure head required is the same for 10 pipes as it is for one pipe. Theoretically, the pressure head required at the bonnet is equal to 0.112 + difference in velocity head at bonnet entry and end of pipe.

7. Given a duct 100 feet long to carry 300 cu. ft. of air. What size duct is required if the pressure loss is not to exceed 0.10 in. of water?

Follow vertical line on 300 in Fig. 2.

Follow horizontal scale on 0.010 line.

Intersection gives following values: Velocity = 630 ft. per minute. Diameter = 9.3 in. Therefore, use a duct whose diameter is greater than 9.3 inches.

Humidity

(*Continued from page 63*)

rated for its attainment being determined by the same changing weather conditions.

In the matter of house temperature the householder relies upon his sense or feeling of warmth or, as has now become a fairly general practice, upon his thermometer as a guide to enable him to control his furnace or boiler. In the matter of humidification, however, he has practically no "sense" of air moisture, except in extreme cases. He will readily recognize excessive air dryness in his house by the "dry feel" of the air, the shrinkage of woodwork and furniture, the presence of "static," the wilting of common house plants, and the necessity of unduly high temperatures for warmth. *His only certain method of ascertaining whether sufficient water is being evaporated for healthful humidification is by keeping a close check on results as determined by a relative humidity measuring instrument, the most common type of which is the hygrometer.*

(To be continued)

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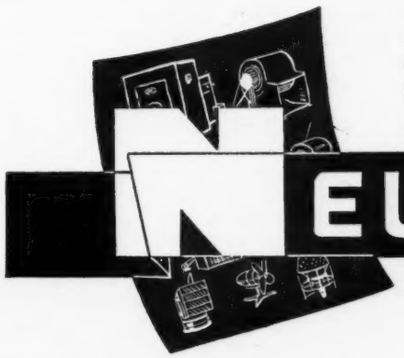

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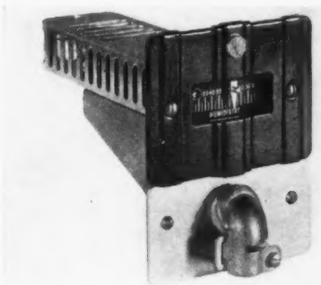
NEW PRODUCTS

● 134—Humidity and Temperature

Julien P. Friez & Sons, Inc., Baltimore, Maryland, has developed a new range of humidity and temperature controls for insertion into ducts, through walls, etc., or for insertion through the cases of air conditioning cabinets, incubators, test chambers, etc. Relative humidity indicators of



the same general design are also now available for similar applications.

The instruments are available either closely graduated in per cent relative humidity from 10 to 100 per cent, or in a variety of temperature ranges, and will be of interest to manufacturers of air conditioning equipment and to dealers, contractors, industrial users, etc.

The makers claim these instruments will provide accurate and reliable control of humidity to within plus or minus 1 per cent R.H. or temperatures to within plus or minus ½ deg. F.

◆

● 135—Air Conduit

Reynolds Corporation, Air Conditioning Division, 19 Rector Street, New York City, has developed the Reynolds system of air conduits with the following results:

It was discovered that all main trunks could be made 8 in. deep and in 13 sizes, varying in width in multiples of 2 in., from 8 x 8 in. to 8 x 30 in. inclusive, with only two sizes of wall stacks necessary, namely, 3 x 12 in. and 3 x 8 in.; the 3 x 8 in. size being used only for limited quantities of air in limited wall spaces. Therefore, the 3 x 12 in. is the standard branch outlet size.

Four sizes of stack-heads are made to fit the four standard grilles, and these fittings, together with the few miscellaneous elbows, makes up the basic Reynolds System of air distribution. These conduits are stocked ready to ship to order in cartons.

The advantages claimed are: Accurate quotations on jobs without first making layouts; low engineering cost on plans, inasmuch as the draftsman quickly becomes familiar with the application of all duct items and their performance characteristics; makes possible a quick take-off of lists of materials; better control of erection labor resulting in lower erection cost; improved head-room conditions in cellars; individual control of both supply and return stack volumes to effect uniform distribution to all rooms; pleasing appearance; snap lock on all joints which ensures virtually air-tight performance of the system.

The conclusions reached and stated in the booklet, "Reynolds Air Conduit in Theory and Practice," by Allen P. Livar, Manager Air Conditioning Division, are based on Reynolds Corporation's experience with Reynolds Air Conduit.

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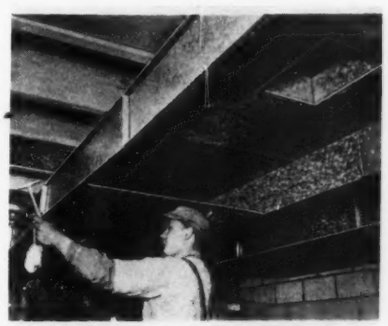
136—Home Air-Duct System

Gar Wood Industries, Inc., Detroit, announces the development of a new, predesigned, air-duct system for automatic home heating and air conditioning.



Runouts from the trunk lines to the grilles are limited to four sizes, all a single depth to fit a standard two-inch by four-inch partition. These sizes are maintained for the entire run without transformation.

137—Two New Attachments

Illinois Testing Laboratories, Inc., 420 North La Salle street, Chicago, Illinois, has recently placed on the market two new jet attachments for the "Alnor" Boyle system velometer.

One, type No. 2460, is used to obtain direct readings of static pressure of ducts, plenum chambers or pipes in inches of water. Static pressure is

measured at right angles to the direction of the air flow. When this type of jet is furnished, with the tube type velometer, an additional range of 0 to 2 inches is provided on the scale to accommodate the jet. This jet can be used for either positive static readings with the jet, tube and fittings attached to the left side of the velometer or for suction or negative readings with the jet, tube and fittings attached to the right side of the instrument.

Jet type No. 2485 when inserted in the air duct or chamber with the opening of the jet pointed directly into the air stream, gives direct reading of total pressure (static pressure plus velocity pressure) in inches of water. A separate range, 0 to 2 inches is provided on the scale when the type No. 2485 total pressure jet is furnished. A small guide fin on the jet at the tube end aids in assuring that the opening of the end is in line with the air stream and facing into the air stream. Inch markings on the jet are provided to enable the user to place the jet at the desired distance within the duct.

◆

138—Inside Measure Steel Tape

The Master Rule Mfg. Co., Inc., 815 East 136th St., New York City, announces a new Master rule suitable for taking inside, outside, depth, height, caliper, marking, radius, and layout measurements. The case acts as one measuring edge.

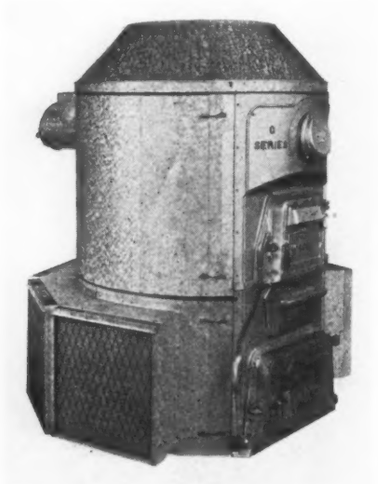
New Products . . . . . .

For your convenience in obtaining information regarding these items, use the coupon on page 97

139—New Moncrief Furnace

The Henry Furnace & Foundry Company, 3471 East 49th St., Cleveland, Ohio, presents the new Moncrief Clean Air Furnace—priced low, and the makers claim it is simple and reliable, and cleans air effectively.

The Moncrief Clean-Air Filter System is supplied in either the Moncrief Series "C" cast furnace or the Series "S" steel furnace, at slight additional cost. In this system, the air is warmed



in the furnace chamber, rises through the warm air ducts, circulates through the rooms and drops to the floor and on down through the cold air faces and cold air ducts to the basement. The bottoms of the cold air ducts are open about 1 foot above the basement floor and release the cooled air which travels across the basement floor and enters the filters, which clean and pass it on to the furnace chamber for heating again.

This system, they say, can be applied to any size or make of furnace already installed. Owens-Illinois duststop filters are standard equipment.

◆

140—Zeph-O-Lator A. C. Units

Century Engineering Corporation, Cedar Rapids, Iowa, gives the following specifications for their Models X100 and X200 Zeph-O-Lator air conditioning units.

Copper bearing steel is used in the shell. Cabinets are constructed throughout of stretcher level automotive steel sheets. Seams and joints in the shell and multiple radiator tube structure are electrically welded and hydrostatically tested against leakage.

The fire and gas travel is exceptionally long, from 30 to 50 per cent greater than conventional practice. Complete combustion and expansion are accomplished in the primary areas of the furnace shell proper. The gases then enter the six radiators and travel downward, coming back to the original shell under the refractory chamber, which acts as a manifold and conducts the gases to the rear and again upward behind the refractory chamber into the stack, where it passes through a blower and filter portion of the unit, thus affording additional heating surface and tempering the incoming air before entering the chimney.

The precast refractory or combustion chamber is of the removable drawer type. In addition, the space between the chamber and the rear of the firebox has an additional lining of Superex insulation for complete protection of the lower metal surfaces from radiant heat.

The Century series "X" units are of the dual filter type—all the air passing through the unit is first washed with a water spray, filtered through two wet filters and again filtered through two dry filters, before entering the blower and continuing on its path of travel through the system. The washing of the air also furnishes correct humidity.

The entire combination of burner, furnace, blower, filters and controls, with the burner entirely concealed in the front portion of the cabinet and the air conditioning unit in the rear,

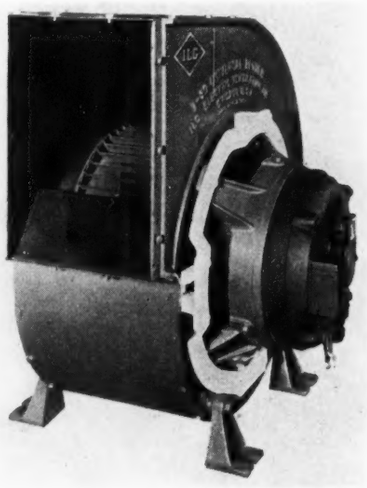
easily accessible through removable doors, results in a cabinet of neat design, occupying small floor space. The X100 requires 26 x 74 inches. The X200 requires 32 x 84 inches.

The units are complete, ready for installation. Control equipment consists of a thermostat, combustion safety control, furnace switch, fan switch and solenoid valve. A direct type of water heater of sufficient size for tanks of from 30 to 60 gallon capacity is included as standard equipment. Both models are equipped with the Model 1A burner with the proper nozzle size.

The X100 unit is designed for an output capacity at the bonnet of 100,000 Btus.; the X200 for 166,000 Btus. per hour. These units are equipped with low speed, multi-vane type of blower of 1200 and 2000 cfm. capacity at ¼ in. static pressure.

Ratings are based on the normal efficiency point of operation.

◆



● 141—Blower Sound Dampening Device

Ilg Electric Ventilating Co., 2850 N. Crawford Ave., Chicago, announces the development of a sound and vibration dampening device for a direct-connected blower. This new mechanism, known as "floated drive bracket" is intended for use on Ilg direct-connected blowers in those installations where extraordinary precautions must be taken in the maintenance of unusual quietness of operation.

The standard Ilg motor bracket is mounted on a second floating bracket which is insulated from the blower housing to which it is secured by flexible rubber cushions. The floating drive bracket is brought into prominence in the accompanying illustration by a white finish. There is no metal to metal contact between this floated drive bracket and the blower housing.

Four point vertical floating of the weight takes complete advantage of all three loading factors—compression, tension and shear—producing the utmost dampening effect.

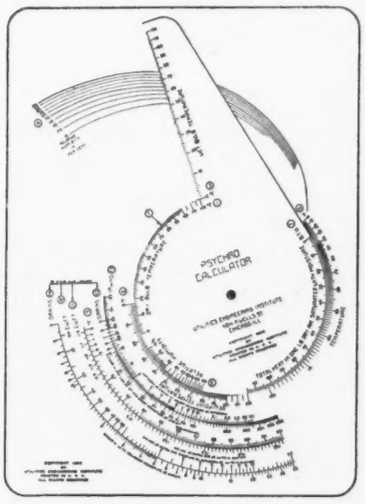
The new Ilg floated drive can be obtained as original equipment on any Ilg type B or type BC direct-connected Universal blower. The floated drive bracket can be mounted on any of these blowers already out in the field.

New Products . . . . . .

For your convenience in obtaining information regarding these new items, use the coupon on page 97

●△ 142—Psycho-Calculator

The Utilities Engineering Institute, 404 N. Wells Street, Chicago, Illinois, announces a recently developed calculator to be used in determining psychrometric values and properties of air and water vapor mixtures. The Psychro-Calculator makes it possible to obtain, by one setting of the mov-



able indicator, any two of the four psychrometric values, i. e., dew point, dry bulb, wet bulb, and relative humidity, if the other two are known.

In addition to serving the purpose of the psychrometric chart, the Psychro-Calculator will give such values as: Weight of saturated vapor per lb. of dry air in grains; vapor pressure in inches of Hg. and weight of saturated vapor per ft.³ in grains, by reading direct from the dew point temperature.

Values found from the wet bulb temperature are: total heat in Btu./lb. of dry air with vapor to saturate and the difference in total heat of any two wet bulb temperatures.

Values that may be read directly from the dry bulb are: volume in ft. of one lb. of dry air, without any adjustment, and the volume of moisture to saturate one pound of dry air. These values make it possible to evaluate any partially saturated mixture from 0° to 120° F.

The Calculator is 7½ x 10½ inches and is finished with a surface that can be cleaned.

◆

143—New CirCOOLator Attic Package

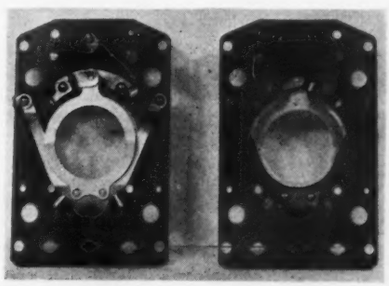
Viking Air Conditioning Corporation, 1935 Euclid Avenue, Cleveland, Ohio, announces the new CirCOOLator Attic Package, said to combine all of the equipment needed for complete attic installation into a single kit. This kit includes a rubber mounted, quiet operating fan with vent box and connection for the attic, a ceiling register with moulding trim, pulleys, rope, fittings and automatic motor starting switch.

The CirCOOLator is available in three sizes, 30-, 36-, and 45-inch, having respective capacities of 6,100, 10,000 and 15,000 c.f.m.

◆

144—Motor Thermal Release Switch

The Leland Electric Company, 1501 Webster St., Dayton, Ohio, has just completed the development of a cut-out switch which operates from both the heavy current encountered during starting conditions and from internal motor heat encountered during heavy



running overloads. This switch operates in such a way as to cut the motor off the line before it is damaged.

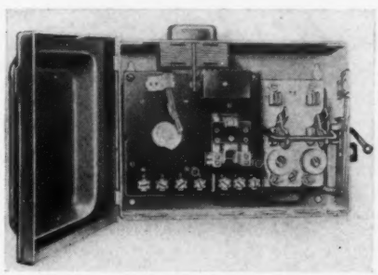
The thermal release switch is intended as a protective device. It is small, inconspicuous, and easily resetable.

◆

145—New Stoker Controls

The Penn Electric Switch Co., Des Moines, Iowa, has just announced the addition of a number of new features to stoker combustion controls.

Features include the patented, trip-free bimetal overload protective unit,



and built-in knife switch and fuse receptacle, as well as the standard synchronous electric timer for maintaining proper combustion at all times, the pilot relay and the transformer for supplying low voltage current to the thermostat circuit.

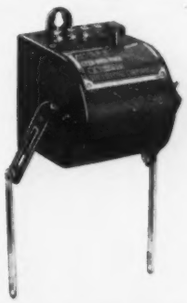
The bimetal overload unit is equipped with a trip-free reset button which makes it impossible to block the contacts closed.

◆

146—Mercoid Damper Control

The Mercoid Corporation, 4201 Belmont Avenue, Chicago, Illinois, announces a new damper control, equipped with a thermal starting switch said to operate on 3 watts at 16 volts.

The power unit consists of a small, but powerful, four-pole induction motor, requiring only 12 watts for operation. Special bearings in the motor permit it to run almost indefinitely without being oiled. The Bakelite gear to the motor pinion insures quiet



operation. The heavy speed reduction gears, under normal operation, are said to last a lifetime. The motor operates at 16 volts, on current supplied by special bell-ringing type transformers, listed as standard by Underwriters Laboratories, Inc.

Type B-11 damper control is also available in four different combination sets.

◆

147—Kewanee Conditioner

Kewanee Boiler Corporation, Kewanee, Illinois, is supplementing its line of residence boilers with air conditioning.

The Kewanee Type RK conditioner teamed with a Kewanee Type "R" boiler produces, they say, a controlled supply of clean air automatically warmed, humidified and positively circulated so as to keep the home comfortable and healthy all winter and ventilated in summer. The combination is also said to promote fuel savings, prolong the life of the building and keep the home furnishings clean.

Features of the RK conditioner include: Air filter of the viscous throw-away type which can be renewed easily; a heating coil of copper tubes with aluminum fins rolled into cast iron headers; thermostatic bulb to check the air delivery if no steam is fed to the coil; control cabinet with transformers to operate humidifying spray nozzle and relays to burner or stoker; self cleaning spray nozzle in humidifying chamber; blower fan with acoustically lined venturi discharge to set air in quiet motion; resilient mounted motor (non-interfering with radio) driven by silent V belt. Kewanee Circular RK-92 with details will be sent upon request.

Robinson-Patman Act

(*Continued from page* 15)

a price lower than Manufacturer B has been giving his customers in a like class. These manufacturers, A and B, meet in competition for the business of a customer new to both of them. A quotes his usual price and it, having been lower than B's, is a legal and nondiscriminatory price so far as Manufacturer A is concerned; but should Manufacturer B meet Manufacturer A's price, he, B, is making a discriminatory price—lower than that given Manufacturer B's other customers. Where, then, does Manufacturer B stand in the eyes of this Act? Does Congress have the power to deny to business men the right to meet legitimate competition?

Commission, Brokerage

"Sec. 2 (c) That it shall be unlawful for any person engaged in commerce, in the course of such commerce, to pay or grant, or to receive or accept, anything of value as a commission, brokerage, or other compensation, or any allowance or discount in lieu thereof, except for services rendered in connection with the sale or purchase of goods, wares, or merchandise either to the other party to such transaction or to an agent, representative or other intermediary therein where such intermediary is acting in fact for or in behalf of, or is subject to the direct or indirect control, of any party to such transaction other than the person by whom such compensation is so granted or paid."

This subsection seems to go a long way. It is unlawful to pay or receive a commission, brokerage, or other compensation except for services actually rendered to or for a person paying such fees, and only then when the party receiving them is not in any way controlled by or interested in the other party to the transaction. It apparently was quite clear to the sponsors of this bill that a buyer, or his agent, could render no service to a seller in connection with a sale to himself. This must have been planned to stop secret discounts, rebates, etc. But whether this is true remains to be seen. Again, what does this paragraph mean when read in conjunction with Section 4, dealing with Co-operatives?

Equal Terms to All

"Sec. 2 (d) That it shall be unlawful for any person engaged in commerce to pay or contract for the payment of anything of value to or for the benefit of a customer of such person in the course of such commerce as compensation or in consideration for any services or facilities furnished by or through such customer in connection with the processing, handling, sale, or offering for sale of any products or commodities manufactured, sold, or offered for sale by such person, unless such payment or consideration is available on proportionally equal terms to all other customers competing in the distribution of such products or commodities."

The significant phrase above seems to be "unless such payment or consideration is available on proportionately equal terms to all other customers competing in the distribution of such products." Thus it would appear that a manufacturer or seller may, if he grants the same terms, commissions, brokerage, or other compensation to all alike, do so with legal intent. He may give free goods, advertising allowances, or what not, so long as he treats all customers on "proportionately equal terms". But what does "proportionately equal terms" mean? Does it mean equal terms to all, or may the seller increase and decrease his allowances for slight increases and decreases in volume of purchases? This language requires interpretation before it can be relied upon.

"Sec. 2 (e) That it shall be unlawful for any person to discriminate in favor of one purchaser against another purchaser or purchasers of a commodity bought for resale, with or without processing, by contracting to furnish or furnishing, or by contributing to the furnishing of any services or facilities connected with the processing, handling, sale, or offering for sale of such commodity so purchased upon terms not accorded to all purchasers on proportionately equal terms."

This language, quite similar in effect to the opening sentence in 2 (a) above, seems to have removed the territorial limitation used in 2 (a). It also appears to be limited only to commodities bought for resale. It appears obligatory that the seller shall have the same price and terms for all buyers of his goods, wares, or merchandise on "proportionately equal terms."

"Sec. 2(f) That it shall be unlawful for any person engaged in commerce, in the course of such commerce, knowingly to induce or receive a discrimination in price which is prohibited by this section."

It is now unlawful, apparently, for a buyer to KNOWINGLY INDUCE OR RECEIVE a discrimination in price prohibited by this act. Buyers have always tried to buy as cheaply as possible, while sellers have tried to obtain as high prices as they could. Who can blame them? Goods well bought are half sold. But who can say just how a buyer may know whether he is INDUCING OR RECEIVING a discrimination in price prohibited by this act? Of course, the Act uses the word "knowingly" to qualify the phrase. Frankly, it would seem that the age-old phrase "LET THE BUYER BEWARE" is again coming into common usage.

"Sec. 3. It shall be unlawful for any person engaged in commerce, in the course of such commerce, to be a party to, or assist in any transaction of sale, or contract to sell, which discriminates to his knowledge against competitors of the purchaser, in that, any discount, rebate, allowance, or advertising service charge is granted to the purchaser over and above any discount, rebate, allowance, or advertising service charge available at the time of such transaction to said competitors in respect to a sale of goods of like grade, quality, and quantity; to sell, or contract to sell, goods in any part of the United States at prices lower than those exacted by said person elsewhere in the United States for the purpose of destroying competition, or eliminating a competitor in such part of the United States; or to sell, or contract to sell, goods at unreasonably low prices for the purpose of destroying competition or eliminating a competitor. Any person violating any of the provisions of this section shall, upon conviction thereof, be fined not more than $5,000 or imprisoned not more than one year, or both."

Here we have a very interesting question. "Commerce," as defined in the Clayton Act, excluded INTRASTATE commerce. This section 3 is not part of the Clayton Act and appears to extend the meaning of the word "commerce" to include INTRASTATE commerce. If this be the true construction of the word as here used, it may also be so construed in section 2, and in that case the whole act becomes quite dangerous. As one very able writer on the subject says:

"It may also be possible to construe the Robinson-Patman Act as containing a very clever joker—designed FIRST, to prohibit discrimination generally in section 1, and to include in that section alone the exceptions and limitations necessary to satisfy the more conservative members of Congress; and SECOND to defeat those limitations altogether by re-enacting substantially all the provisions of section 1 with no exceptions or limitations whatsoever and in addition to impose criminal penalties upon their violation.

Section 3 contains three clauses. The first is the most dangerous. It prohibits, in sweeping terms, price discriminations. It contains none of the exceptions and safeguards of section 1, except discounts based upon grade, quality and quantity. If literally construed, every discount or price variation, except for grade, quality, or quantity, is prohibited regardless of either its purpose or effect. It may have the effect of obligating every business man to offer the same price to every customer. Can Congress do this? It would seem to fall within the due process clause of the Constitution, as being confiscation of private property without due process; an unreasonable interference with the freedom of contract. This section 3 requires a great deal of interpretation before it can be definitely understood and applied to the daily affairs of the American Business Man, be he a seller or a buyer.

Incidentally, in passing, we would like to drop a thought. Throughout this Act the word used is "person." There is a Federal "person," known officially as the Tennessee Valley Authority, actively engaged in the task of demonstrating to the industrial world of America that the utilities are charging excessive rates for electric power. Does not that activity on the part of the TVA constitute an act towards the elimination of competition. It is well known that the "yardstick" they use to measure the cost of their production does not include all elements of cost, and yet they are actively engaged in price discrimination and the destruction of competition.

"Sec. 4. Nothing in this Act shall prevent a cooperative association from returning to its members, producers, or consumers the whole, or any part of, the net earnings or surplus resulting from its trading operations, in proportion to their purchases or sales from, to, or through the association."

Just what this section means remains to be seen. It may be just a coincidence that within a week after the President signed this Robinson-Patman Act, he announced the appointment of a Commission to go to Europe to study the so-called consumers' cooperative, a non-profit communistic system long advocated by Secretary of Agriculture Wallace. Under date of September 25, 1936, the newspapers carried the story of the return of this Commission secretly to Washington, but that their report would not be submitted in time for the President to use it for campaign purposes.

This Robinson-Patman Act definitely affects the daily lives of all Americans, and more specifically the Sellers and Buyers. It deserves the serious study of all, and it is our hope that the readers of the Artisan will study this legislation; will consult with their attorneys when in doubt as to its application to their business; and that by so doing they will not come within the clutches of this regulatory act.

News Items . . . . . .

Promotes Galvanized Steel Roofing

T. S. Morrison and Co., 39 N. Lexington Ave., Asheville, N. C. is putting on a fall drive for galvanized steel roofing work.

◆

Excellent Shop Display

Duke Brown, Union City, Tenn., has a very good shop display of roofing, stoves and Williamson furnaces. The furnace department has made a good many autumn installations.

◆

Galvanized Roofing Department

McMinnville Hardware and Furniture Co., McMinnville, Tenn., is showing a large department in super coated safety drain galvanized roofing for residences and super coated corrugated galvanized roofing for every purpose.

◆

Air Conditioned Office in Memphis

Wolf River Terminal and Warehouse Co., Memphis, Tenn. has started erection of a $5,000 air-conditioned office building at the foot of Keel St. It is 49x22. E. L. Harrison, of Memphis, is the architect.

◆

A. Tillman Jones Moves

A. Tillman Jones, Nashville, Tenn., pioneer in the furnace trade is now located in the up-town section at 407 Commerce St. Mr. Jones says the summer season was very active and the autumn outlook is bright.

◆

Roof Inspection Drive

Coast Roofing and Sheet Metal Co., 28th Ave., Gulfport, Miss., had a free inspection drive on roofs from October 19 to 25, and prepared to furnish service for the work before the winter season. N. A. Rice is manager.

◆

Brisk Demand for Cabinets

The Sheet Metal Products Co., 10th and Burnett Sts., Louisville, Ky., has been running at full time with considerable night work. J. H. Wuest reports a brisk demand for utility cabinets, clothes hampers, vegetable bins, kitchen stools and medicine cabinets.

◆

Chattanooga Adds Coal Stoker

Chattanooga Blow Pipe and Roofing Co., 1301 Duncan St., Chattanooga, Tenn., lately completed metal contracts for the Bijou Theatre remodeled and opened in September. The firm also has taken on a coal stoker. They staged some very good floor exhibits during the Tri-State Fair which began September 23.

◆

S. J. Veltman Passes

S. J. Veltman, 70, native of Holland and for fifty years active as a machinist, plumber and heating contractor, died at his home in Paris, Tenn., Aug. 27. He came to Paris 35 years ago from Indiana. He had also worked in Michigan. His family for three generations were active in the same line of work. He is survived by his father, wife and several children. Mr. Veltman, in addition to having a well equipped shop, did considerable work for the L. & N. which has divisional yards here.

With the Manufacturers . .

Cleveland Minneapolis-Honeywell Expands

Minneapolis-Honeywell Regulator Co., Cleveland Branch office, moved into larger and more pretentious quarters on August 1st. Their new address will be 4501 Prospect Avenue, Cleveland.

◆

New Blower Announced

The Blower Division of the Chicago Steel Furnace Company announces a complete line of multivane blowers especially adapted to modernize gravity heating plants. A feature of their plan is the furnishing of proper drawings and layouts to enable the sheet metal man to design a housing for the blower that will fit any size or any type of round furnace, rather than furnishing a factory built housing or to furnish a completely housed blower if the contractor prefers the housed type.

◆

Viking Moves Into Larger Quarters

Viking Air Conditioning Corp., 1935 Euclid Avenue, Cleveland, moved into larger quarters at center and Winslow Streets on August 15.

H. V. Willard announces that a steadily increasing business forced them to acquire greater space for manufacturing operations.

◆

Floyd Lamoreaux Dies

The officers and directors of the Round Oak Company, Dowagiac, Michigan, announce with deep sorrow the death of Floyd Lamoreaux, Purchasing Agent and Traffic Manager, on Friday, October 16.

◆

Berridge Double Cutting Snip

Berger Brothers Company, 229-237 Arch Street, Philadelphia, is distributing the Berridge double cutting snip, manufactured by the Berridge Shear Company, Sturgis, Michigan.

This snip is for cutting and crimping all kinds of sheet metal and pipe of ordinary weight, either round or square. The snip cuts out a very narrow strip of metal, allowing the material to drop down on each side of snip and eliminating twisting.

◆

Granite City, Illinois, Armco Sheets

The American Rolling Mill Company, Middletown, Ohio, has granted a license to The Granite City Steel Company, of Granite City, Ill., to use its continuous sheet rolling patents and cross rolling patents, according to an announcement by Charles R. Hook, president of Armco.

With the completion of this new continuous mill, the Granite City plant will be completely equipped for the production of hot and cold reduced sheets.

◆

New Armco Distributors

The American Rolling Mill Company, of Middletown, Ohio, announces the appointment of five new distributors of Armco Ingot Iron and Armco stainless steels.

The Edgcomb Steel Co., of Philadelphia, and the Edgcomb Steel Corp., of Newark, N. J., have been named distributors of Armco stainless steels.

Those recently appointed to distribute Armco Ingot Iron are: Syracuse Supply Co., Syracuse, N. Y.; Alamo Iron Works, Brownsville and Corpus Christi, Texas; Klauer Manufacturing Co., Dubuque, Iowa, and the Central Steel and Wire Co., Chicago.

With The Manufacturers . .

Sioux Falls Corrugating Changes Name

The Sioux Steel Co., Sioux Falls, South Dakota, is the new name for the former Sioux Falls Corrugating Co., manufacturers of Sioux sheet metal products.

The directors, stockholders, management and entire personnel will remain the same, but the name has been changed in line with the progress of this Company, because they say it is more descriptive of its many products.

◆

G-E Oil Furnace Price Reduction

The General Electric Company announces price reductions in their oil furnace, effective since October 15. They say increased production has enabled General Electric to effect these savings, which it is passing along to the consumers in accordance with its established policy.

The wide public acceptance of the oil furnace has been brought about largely by newspaper advertising, company officials believe. Newspaper space will continue to be a major part of the company's promotional program.

◆

Payne Furnace in New Office Building

Payne Furnace & Supply Co., Inc., 338 North Foothill Road, Beverly Hills, California, has completed construction of a fine new office and show rooms—including auditorium, cooking school, etc.

◆

Christiansen with Automatic Products Co.

H. Christiansen, formerly with the Underwriters Laboratories as testing engineer, is now connected in a sales capacity with the Automatic Products Company of Milwaukee.

Mr. Christiansen's special knowledge of the oil burning appliances such as space heaters, circulating heaters, hot water heaters, etc., will enable him to help the manufacturers with their problems of automatic control of oil.

◆

Christman to Manage Chicago Milcor Plant

Louis Kuehn, president of the Milcor Steel Company, announces J. Harry Christman is in complete charge of Milcor's Chicago plant.

Mr. Christman was formerly sales manager at Milwaukee and has for some time been a vice president of the company.

◆

Turner Brass Expands

The Turner Brass Works, Sycamore, Ill., has acquired a 143 by 102 foot brick building adjacent to its main plant and has re-equipped it for office space and product development laboratories at a cost of more than $40,000. John Slezak, vice-president, states that office headquarters at the plant had been cramped for the past year and a half and more space was needed.

Elaborate display rooms are being constructed in the new building in which a permanent display of every item in the Turner line of blow torches, lamps, lanterns, water heaters, camp stoves and brass specialties will be arranged. Cut-away samples and integral parts will be included in the display. A section of the building is to be devoted to experimental and development work on new products.

The building, of one-story, brick construction, has 15,000 square feet of floor space.

New Literature . . . .

For your convenience in obtaining copies of new Literature, use the coupon on page 97.

380—Revised List Prices

Acer and Whedon, Inc., Medina, N. Y., is distributing pamphlet No. 4 with revised list prices covering their Standard forced air pipe and fittings systems and air conditioning, furnace pipe and fittings with patented snap lock, galvanized pipe and elbows, stove pipe and adjustable elbows.

◆

381—A New Service

Robert Barclay, Inc., 122 North Peoria Street, Chicago, is distributing their catalog No. 101 (September, October and November, 1936) of accessories for automatic heating dealers, service and installation men. They advertise all accessories for oil burners, stokers, and gas fired equipment, under one roof.

The catalog is indexed and prices given are in effect until the December issue.

◆

382—Fuller Asbestos Dry Paste

The J. M. and L. A. Osborn Co., is distributing a new leaflet on Fuller's "Asbestos" dry paste, manufactured by H. B. Fuller Company, St. Paul, Minnesota, for furnace, boiler and pipe covering work.

This paste is said to be convenient, economical and dependable for applying asbestos paper and cloth coverings to hot air furnaces and pipes, hot water boilers, steam plants, ventilating systems, etc. It is in powder form.

◆

383—Air Conditioning Progress

Willis H. Carrier, Chairman of the Board, Carrier Engineering Corporation, 850 Frelinghuysen Avenue, Newark, N. J., presented a paper entitled "Progress in Air Conditioning in the Last Quarter Century" before the semi-annual meeting of the American Society of Heating and Ventilating Engineers at the joint session with the American Society of Refrigeration Engineers, on June 23, at Buck Hill Falls, Pennsylvania. This paper is now in reprint form, being reprinted from Heating, Piping and Air Conditioning. The document reviews the development leading up to Mr. Carrier's disclosure of the Rational Psychrometric Formulae in 1911. The progress in the last quarter century is then covered, with regard to Carrier equipment and uses.

◆

384—New Russell Literature

Russell Electric Company, 340 West Huron Street, Chicago, is distributing a manual for sales, installation and service of Hold-Heet Air Conditioners, for winter air conditioning and summer cooling for the average home. They say this manual tells the story of home air conditioning so that the man on the street can understand it.

The Hold-Heet system of home air conditioning is described in another new piece of literature as supplying the following air conditioning functions: Forced heat delivery to each room, automatic temperature control, air circulation (ventilation), air filtering, automatic humidity supply and control, effective summer cooling for the house by employing the night air principles, and filtered removal of pollen and dust for hay fever relief. Specifications for the modern air conditioned home are included with a description of the Hold-Heet system.

Envelope stuffers entitled "Fine Stokers Deserve Fine Controls," "Only the Hold-Heet DeLuxe Regulator Set Includes the Vitally Important Combustion Control in the Stack," and "You are Lucky If You Have a Warm Air Furnace for It Will Cost So Little to Air Condition Your Home," are also being distributed.

New Literature . . . .

For your convenience in obtaining copies of new Literature, use the coupon on page 97.

385—De Luxe Comfortmaker

Joliet Heating Corporation, Joliet, Illinois, is distributing a 4-page folder illustrating and describing Comfortmaker air conditioners—Models E, F, O and G.

Models E and F are designed for coal, oil and gas, Model O is oil-fired while Model G is gas fired.

◆

386—Expert Soldering

Stanley Tools, new Britain, Conn., has a new folder entitled "Expert Soldering," available upon request.

The folder describes Stanley electric soldering irons, illustrates the various sizes with a table of specifications, prices and uses. On the inside there are instructions for expert soldering and suggestions for the care of the Stanley electric soldering iron and cord.

◆

387—Engineering Pointers on Motors

The Lincoln Electric Co., 12818 Coit Road, Cleveland, Ohio, is distributing a new folder entitled "Engineering Pointers on the Application, Selection, Installation of Totally Enclosed Fan Cooled Motors." They say the facts contained are intended as a guide in selecting the right motor for operation in severe, particle-laden atmosphere.

Specifications are included for "Linc-Weld" Type "E" motors.

◆

388—Korfund Vibro Dampers

The Korfund Co., 48-15 Thirty-second Place, Long Island City, New York, announces the publication of a new Bulletin—No. 53-C—on the Korfund standard series Vibro-Dampers, entitled "Vibration Isolation by Means of Steel Springs."

This bulletin treats the subject of machinery isolation in a novel manner, especially since the elimination of vibration is becoming of increasing importance.

◆

389—Auburn Stoker Literature

Auburn Foundry, Inc., "Stoker Division," Auburn, Indiana, is distributing several new pieces of literature—a general catalog covering Auburn ram feed stokers and several folders. The Auburn Type D stoker is designed for all sizes of warm air furnaces and boilers; and Type DLD, line drive, feeds from bin to burner.

The stokers cover the field from 4 to 1000 boiler h.p.

◆

390—J-M Industrial Products

Johns-Manville Corporation, 22 East 40th St., New York City announces the 1936 edition of the Johns-Manville Industrial Products Catalog. This 60-page book, illustrated, contains information and recommendations on high and low temperature insulations for every industrial need, specifications on J-M Bonded Asbestos Built-up Roofs, and J-M Insulated Roofs; detailed information on J-M Corrugated Transite for roofings and sidings: on industrial friction materials; on Transite Conduit, Asbestos Ebony and other J-M electrical materials; on Transite Pressure Pipe for industrial and municipal water lines; and on J-M packings.

Among new products described in detail are Transite Korduct, a thin-walled form of asbestos-cement electrical conduit; Rock Cork Pipe Covering, a mineral insulation for low temperature piping, and J-M Ohmstone, a non-impregnated asbestos-cement sheet for switchboard panels that will stand shock and vibration and is immune to carbonization.

The catalog also describes in detail Steeltex Floor Lath and Welded Wire Re-inforcement, and sound control of mechanical equipment.

Church Heating

(*Continued from page* 24)

70 equals 40, or .227 × 40 = 9.08. This item is not shown on the data sheet, but is carried on the margin of the sheet, and referred to when the B.t.u. is calculated under items 15, to 21.

Item 8 is all exposed window or door cracks where leakage or infiltration might take place. Item 9 is B.t.u. loss per linear foot of crack. Item 10 is exposed wall total area. Item 11 is exposed window and door area, and we subtract Item 11 from Item 10 for Item 12. Item 13 is taken from the compass points on the plan. Item 14 is room temperature.

Item 15 is item 12 times factor in Item 7, except as noted. For all rooms on the ground floor, one-half of the wall is below grade with a factor of 9.08 and a factor of 18.16 above grade or an average of 13.62. Hence for all rooms on the ground floor we multiply the wall area in Item 12 by 13.62 for Item 15.

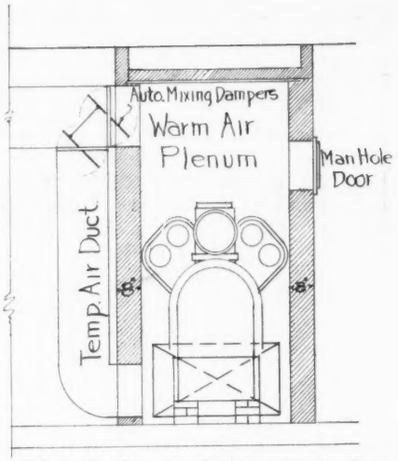
Item 16 is Item 11 times the factor in item 6. Item 17 is item 15 plus item 16. Item 18 is item 17 times the percentage for the exposure as shown in item 13. This percentage factor is found in the upper left hand corner of the data sheet.

Item 19 is omitted on this plan, as the floor loss is practically nothing. Item 20 is exposed ceiling, times the factor in item 5. The auditorium is the only room with an exposed ceiling. Item 21 is item 9 times item 8. Item 22 is the sum of items 17 to 21 inclusive.

For Item 23 we deduct one-half of Item 21 as this is infiltration loss and is figured for all exposed window and door cracks. We know in practice that only one or two sides of the building will be exposed to any wind and the opposite side will not have an infiltration loss. Item 24 is Item 22 minus Item 23.

Our next item, 25, is air supply in c.f.m. It is necessary for us to know what the register temperature will be before we can calculate this item and a survey of our problem is necessary.

This practically completes the filling in of the data sheet. The reader should notice that the items can be filled in without consideration of any underlying theory—just horse sense and experience are required. This is one advantage of a sheet like this. Also the filling in follows step by step—overlooking no item.



Although this particular church does not use a mixing damper system, a great many church systems have a heater arranged as shown. The thermostat actuates the mixing damper to admit more warm air and less cool air to the ducts when the thermostat calls for heat and vice versa.

(Part 2 will follow)

New Literature . . . .

For your convenience in obtaining copies of new Literature, use the coupon on page 97.

391—Aerocrat Furnace Blower Guide

W. R. Ames Company, 150 Hooper St., San Francisco, is distributing a four-page folder illustrating and describing the various types and sizes of Aerocrat furnace blowers and wheels. A condensed table of available sizes is given. Blowers are available for individual furnaces of inputs of from 80,000 to 500,000 Btu per hour or more.

◆

392—Arc Welding Technique

The Lincoln Electric Company, Cleveland, Ohio, is distributing a new 20-page booklet entitled "The New Arc Welding Technique," and illustrates and describes the new "Shield-Arc S. A. E." welder. This new machine has dual continuous control, said to improve welding techniqu and allows the operator to control both welding current and open-circuit voltage.

◆

393—MetaLayer—A Process and Equipment

Metals Coating Company of America, 495 North Third Street, Philadelphia, originators and developers of the sprayed molten metal coating process, is distributing file folder No. 1203, illustrating and describing the MetaLayer—the process and equipment.

The MetaLayer is a process and equipment for simultaneously melting, atomizing and spraying coatings of any metal on any surface regardless of size, shape or location.

The HI-CAP MetaLayer uses commercial metal in wire form as the raw material.

◆

394—Eisler Booklet 36-AC

Eisler Engineering Co., 749 S. 13th St., Newark, N. J., is distributing Booklet 36-AC, entitled "Weld It with Eisler A. C. Arc Welders—a type and size for every need." Both arc and spot welders and accessories are illustrated and described.

The company maintains a complete test welding service, and offers co-operation in solving your welding problems. The experimental department will make test welds on unassembled samples and return them with information and machine recommendations.

◆

395—Isolation

The Korfund Company, Inc., 48-15 Thirty-second Place, Long Island City, New York, is distributing a new general catalog on anti-vibration products, entitled "Isolation." This publication is devoted to the study of soundproofing and the isolation of machine vibrations.

"Elementary Considerations of Vibration Control" an abstract of a paper presented by S. Rosenzweig, president and consulting engineer of the company, at the Oil and Gas Power meeting of the American Society of Mechanical Engineers held at the University of Michigan, Ann Arbor, Michigan, in June, 1936, is the leading article in this September edition.

◆

396—New Barber Catalog

The Barber Gas Burner Company, 3702 Superior Avenue, Cleveland, Ohio, has just brought out Catalog No. 37, containing a complete presentation of the Barber line of gas conversion burners, burner units, pressure regulators, gas shut-off valves, and control equipment, as well as valuable engineering and technical data.

The combustion principle of the Barber jet gas burner provides for the introduction of auxiliary air above the gas orifice in the jet tubes. As the pre-mixture leaves each pair of jets, a vacuum is created which draws into the flame the additional air required to develop perfect combustion upon increased gas pressure.

Barber burners for industrial uses are also covered.

New Literature . . . .

For your convenience in obtaining copies of new Literature, use the coupon on page 97.

397—Power Press Bulletin

Niagara Machine & Tool Works,, 637 Northland Avenue, Buffalo, New York, is distributing a new bulletin covering their No. 101 Power Press. The press is said to be a popular seller to manufacturers of small metal stampings.

FOR YOUR CONVENIENCE

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Please ask the manufacturer to send me more information about the equipment mentioned under the following reference numbers in "New Products" and "New Literature." (Check numbers in which you are interested):

134	135	136	137	138
139	140	141	142	143
144	145	146	147	
380	381	382	383	384
385	386	387	388	389
390	391	392	393	394
395	396	397		

Name .....**Title**.....

Company ....

Address .....

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Statement of the Ownership, Management, Circulation, Etc., Required by the Act of Congress of March 3, 1933

Of American Artisan, published monthly at Chicago, Illinois for October 1, 1936.

State of Illinois, County of Cook, ss.: Before me, a Notary Public in and for the State and county aforesaid, personally appeared F. P. Keeney, who, having been duly sworn according to law, deposes and says that he is the business manager of the American Artisan, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:
Publisher, Keeney Publishing Company, Chicago, Illinois.
Editor, J. D. Wilder, Chicago, Illinois.
Managing Editor, J. D. Wilder, Chicago, Illinois.
Business Manager, F. P. Keeney, Chicago, Illinois.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.)
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3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the twelve months preceding the date shown above is. ..... (This information is required from daily publications only.)

F. P. Keeney,
Business Manager.

Sworn to and subscribed before me this 1st day of October, 1936.
(SEAL) Grace E. Waymire, Notary Public.
(My commission expires February 10, 1938.)

Skylight Construction

(*Continued from page* 17)

Before bending in the brake the vertical corners *t* and *t* are creased, and after bending these creases are turned at right angles and the one corner riveted and soldered. Using this style of ventilator, the distance of the cap flashing Y in diagram XX in Fig. 13, must be notched out at the top of the common bar pattern as indicated on one side of the pattern by the shaded notch Y. This notch must be placed on the opposite side also.

Two more patterns will be required—that of the hip and jack bars. Before these patterns can be developed, a plan view is required as is shown below the sectional view. First draw the outline of the quarter plan and its hip line at an angle of 45 degrees. Now where lines drawn through the points 1 to 6 in the common bar in the sectional view intersect the skylight curb at the bottom and the vent-curb at the top, at points also numbered 1 to 6, drop vertical lines to intersect the hip line in plan and from these intersections draw horizontal lines to meet the center line, all as shown. Now at right angles to the hip line in plan, draw any line as *a-b* and measuring from the center or hip line, set off the projections of the common bar in the sectional view, measuring from the center dotted line, all as shown by similar numbers 1 to 6 on *a-b*. Through these points 1 to 6 on *a-b*, parallel to the hip line, draw lines to intersect similar numbered lines dropped vertically from similar numbered intersections previously obtained, thus obtaining the intersections 1^v to 6^v at the skylight curb in plan and 1° to 6° at the vent-curb. These points of intersections will be required in finding the true elevation of the hip bar and its pattern, and to avoid a confusion of lines will be reproduced elsewhere as we proceed. The pattern for the jack bar is now in order.

Take similar projections on *a-b* and set them off at right angles to any horizontal line in the plan of the jack bar, regardless of its location, as long as the bar is placed horizontally as shown. Intersect the jack bar with the one half plan of hip bar as shown by the short and long miter lines 1′ to 6′ and 1′ to 6″. From these intersections erect vertical lines to intersect the common bar as shown. Note that the miter line 1′ to 6′ in the sectional view indicates the intersections of the short miter line in plan of similar numbers, while the miter line 1′ to 6″ in the sectional view shows the intersections on the long miter line 1′ to 6″ in plan.

Now at right angles to the pitch of the common bar in the section view, and from the intersections 1′ to 6′ and 1′ to 6″ draw lines to intersect similar numbered lines in the common bar pattern, thus obtaining 1′ to 6′ on one half of the pattern and 1′ to 6″ on the other half, all as shown. When laying out the full size length of common or jack bars always measure from the arrow points on the glass line or line 2. The reason measurements are made on the glass line is that the length of the various bars (which will be determined later) gives at once the length of the light of glass minus 1/8 inch for play, the width of the lights being determined by the spac-

ings between the bars, minus 3/16 inch for play. In this way on a large skylight job, the glass can be ordered direct from the manufacturers long before the skylight is assembled. To obtain the true elevation and pattern for the hip bar refer to Fig. 15 in which the plan view is an exact reproduction of the plan in Fig. 13.

Parallel an equal to the hip line in Fig. 15, draw any line at pleasure as A-C. From A erect the perpendicular line A-B equal to A-B in Fig. 13. From 2^{v} in plan in Fig. 15 erect the perpendicular line to intersect the line A-C at $2^{\circ\circ}$. Draw a line from $2^{\circ\circ}$ to B, the true length of the hip. From the various points of intersections 1^{v} to 6^{v} and 1° to 6° in plan, at right angles to the hip line, erect lines indefinitely as shown. Now measuring in each and every instance from the line A-C in the sectional view in Fig. 13, take the *vertical* heights to points 1 to 6 in the lower curb and the *vertical* heights 1 to 6 in the vent-curb and place them in Fig. 15 on lines previously drawn from similar numbers in plan, measuring in each and every instance from the line A-C and in this way obtain the points 1 to 6 in the lower curb and points 1 to 6 in the upper vent-curb. Connect these points by lines as shown, which if correctly projected will be parallel to the line B-$2^{\circ\circ}$.

Take the projections of the points *a-b* in plan and place them parallel to the pitch in the true elevation as shown on the line *a'b'*. From these points erect lines at right angles to the pitch intersecting similar numbered lines in the true elevation of the bar, and in this way obtain the true section or profile of the hip bar, whose pattern is laid out as follows: Take the girth of the hip bar 1 to 6 and set it off on the line E-D drawn at right to the pitch as shown. Through these small figures, at right angles to E-D draw lines indefinitely and intersect them by lines drawn parallel to E-D from similar numbered intersections shown in the true elevation at the hip bar, thus giving the pattern shape as shown by the solid lines. This completes the patterns for hip, jack and common bars for a skylight as shown in Fig. 12.

When a skylight is required as shown by the plan in diagram D in Fig. 15 where only four hip bars are required which intersect and miter at the apex, then a different miter cut will be necessary and is obtained as follows: From the intersection 1°, 2° or 4° in the plan of the hip bar, draw the horizontal line 4°-*t* cutting the hip bar at 5^{T}, 3^{T} and 6^{T}. From these interesections erect dotted lines as shown, intersecting similar numbered lines in the true elevation at 3^{T}, 5^{T} and 6^{T}. From these intersections at right angles to the pitch, draw lines intersecting similar numbered lines in the pattern on both sides also at 3^{T}, 5^{T} and 6^{T}. Connect these points by dotted lines as shown, then will the *dotted* miter cut 6^{T} to 1^{S} to 6^{TT} be the proper cut for a square skylight in which the four hips miter as shown in diagram D.

When a skylight is to be constructed with a ridge bar as shown in diagram E and the hips miter as shown, two halves intersecting each other and the opposite halves intersecting the ridge bar, then the miter cut is indicated in the hip bar pattern by the *solid* line from J to 1^{S} for the one half and the miter cut from 1^{S} to U to 3^{TT} to V to 6^{TT} for the opposite half.

In the construction of skylight where common jack bars and center jack bars are required as shown in diagram F, it becomes necessary to change the positions of the various miter cuts shown in the patterns for common and jack bars in Fig. 13 and lay out stub patterns. For the pattern for the center jack bar shown in diagram F in Fig. 15, take a reproduction of the half cut to the jack bar in Fig. 13 from 1′ to 3″ to 6″ and place it in Fig. 15 on either side of the center line H-L in the upper left hand corner as shown from G to H to I which will have the proper miter cut for the center jack bar mitering over the two hip bars as shown by similar letters G-H-I in diagram F.

For the pattern for the common jack bar, take one-half of the jack bar cut from 1′ to 3″ to 6″ in Fig. 13 and the opposite half cut of the common bar from 1^x to 6^x and place them on either side of the center line H-M in Fig. 15 in the upper right hand corner as shown by J-H and H-O, respectively, which will be the proper miter cut for the common jack bar mitering over the hip and ridge bars as shown by similar letters in diagram F. This completes the entire set of skylight patterns required for the fabrication of any type or size hipped skylight with various positions of the skylight bars.

Sheet Metal Distributors

(*Continued from page* 21)

paid by the dealer. The committee declares that the direct car discount of 6 per cent is hardly sufficient for the true jobber who sells a direct carload to a dealer but is ample or too much for the jobber who accepts a carload order sold by some manufacturer's salesman for him. He simply acts as a clearing house. Under the present plan, dealers are not entitled to any type of quantity rebate so that there will be no way for the retailer through quantity discount rate to secure approximately the same price as secured by the jobber.

Jobbers Reports

The asphalt shingle committee reported that some manufacturers, in order to comply with provisions of the Robinson-Patman law, are requiring jobbers to fill out a complicated affidavit each month to show how much of the jobber's purchases were resold to dealers and to which dealers such sales were made. The Committee feels that this is an undue bookkeeping process and that distributors who are 100 per cent wholesalers should be allowed to fill out a simple affidavit each month stating that none of the goods sold during the previous month were sold to ultimate consumers. The jobber would then receive a credit of ten per cent on his entire purchases when such affidavit is formally filed with the manufacturer. Where jobbers are largely wholesale, but do maintain a small retail department, the simple affidavit might be filled out to show the percentage of sales made at wholesale each month so that the firm could secure the ten per cent service commission. The committtee recognizes the shortcomings in the affidavit but suggests that a possible solution would be the requirement that all buyers of roofing decide whether they desired to be strictly a wholesale house and sell nothing at retail or to be strictly a retail dealer outlet. Such a plan could be adopted and if adopted, the industry would be served by a limited number of wholesalers who did no retailing whatever.

The association, upon recommendation of the nominating committee, adopted the motion that the spring meeting of the association which was abandoned during the depression be reinstated as of May, 1937. In compliance with this recommendation, the May meeting will be held in Cleveland.

CLASSIFIED ADVERTISING

4 cents for each word including heading and address. Count seven words for keyed address. Minimum $1.00 for each insertion. One inch $3.00. Cash must accompany order. Copy should reach us eight days in advance of publication date. Display rates for this page will be furnished on request.

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November, 1936

ELECTED on an Economy Platform

Sheet metal workers cast an overwhelming vote of preference for these cost-cutting Products.

With a long-established record of cost-cutting performance on sheet metal jobs these famous Parker-Kalon Products are natural favorites among buyers who are reluctant to "gamble" on "campaign promises". When you specify "Parker-Kalon" you get guaranteed help in doing better work, with less time and labor. If you are not acquainted with all of them, ask your supply house for folders, or write us.

PARKER-KALON CORPORATION, 190 Varick Street, New York, N. Y.

1. ***To join or make fastenings to sheet metal*** — not over 18 gauge (.050″) thick keep a good supply of the genuine Sheet Metal Screws, made only by Parker-Kalon. They'll do it the simplest, cheapest way . . . just turn them into punched, pierced or drilled holes. They *always* work right . . . genuine Sheet Metal Screws are uniformly good.

2. ***Where fastenings to brick, mortar or concrete are required,*** Hardened Masonry Nails will save you time and do away with expensive devices. Substantial fastenings are made simply by hammering the Masonry Nails into the material, just as you drive a nail into wood. Only in very hard material do you have to drill a small starting hole.

3. ***For secure sheet metal-to-wood fastenings*** — Hardened Screwnails are being widely used. You can drive them right through the sheet metal in most cases. The hardened spiral thread cuts into the metal and worms into the wood, holding like a screw.

4. ***On all work that requires a metal punch*** — you can't beat the famous Hyro No. O.X. for all-around efficiency, convenience and value. It is the strongest punch of its size on the market, and it comes in a sturdy steel case containing a full set of 7 punches and 7 dies . . . all for $5.90 (F.O.B. New York).

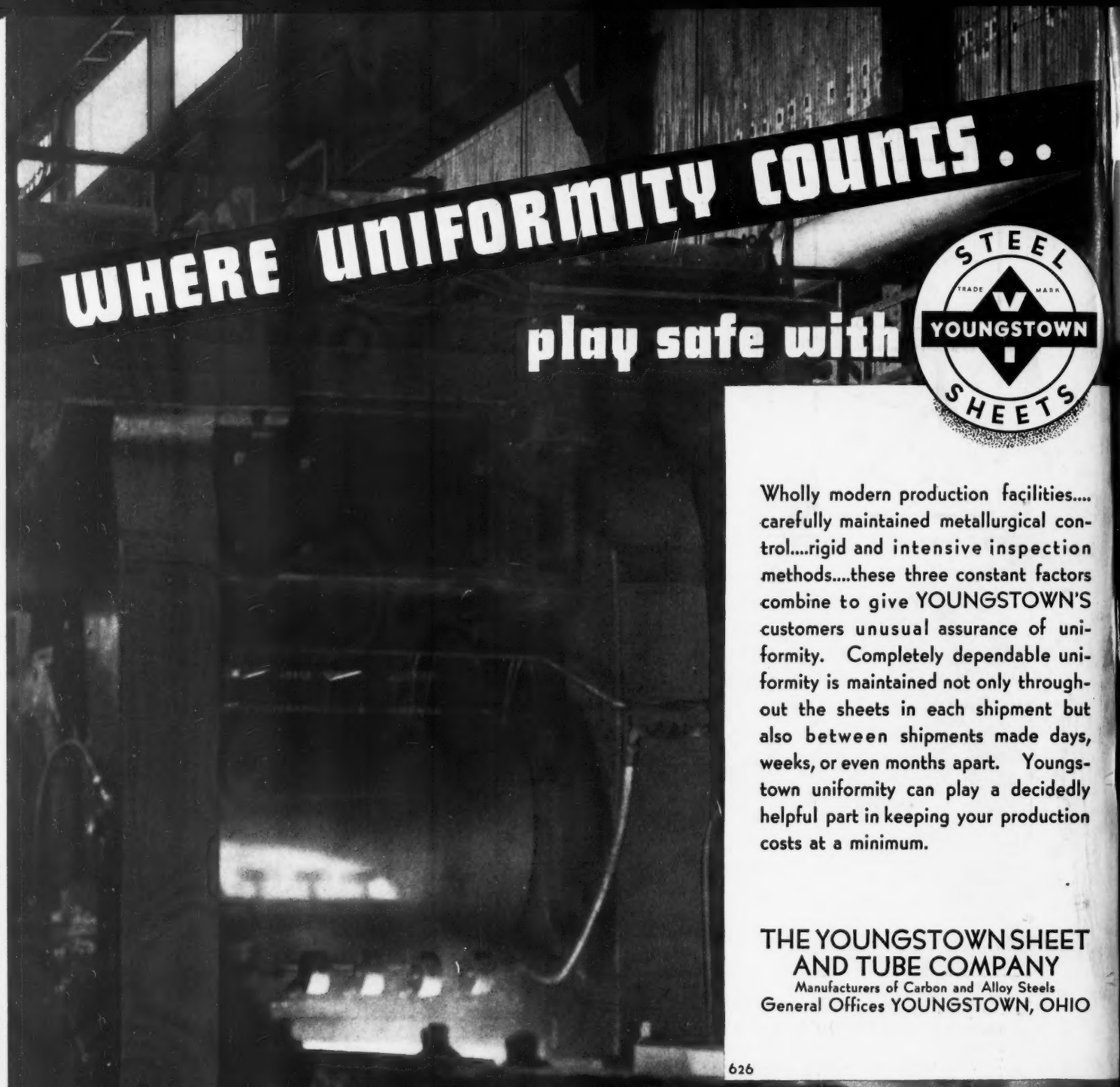
5. ***Handles that Screw-on and Stay-on*** a solder iron or file save time, temper, trouble and injuries. Hyro Shur-Grip Solder Iron Handles and File Handles cut a thread on the stem of an iron or a file tang as they are screwed on. Try these handles that cannot loosen or slip off accidentally . . . see why they are so popular.

6. ***Everything for a Damper Control installation*** — comes in the Hyro UNXLD Damper Quadrant or Dial Damper Regulator Sets. No need to waste time in getting together the necessary Damper Bearings, rivets and Parker-Kalon Sheet Metal Screws. These accessories are packed in a single box, with one of the famous Hyro controls which are "standard" among sheet metal workers.

Products of

PARKER-KALON CORPORATION

Sold only through recognized distributors



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